

CLASS
10



**PHYSICS
WALLAH**

CBSE

15 **SAMPLE QUESTION PAPERS**

NEW PATTERN

*As per Latest **CBSE SQP** (Dated 30 July 2025)*

**MATHEMATICS
STANDARD**

With CBSE SQP, 2024 & 2025 Solved Papers

2026
EXAMINATION

Additional Features

- **14** Cheat Sheets (Mindmap)
- **111** Most Probable Questions
- **4** Answering Templates
- **3** SQPs with Marks Breakdown



CONTENTS

Scan for Latest
Syllabus &
Upcoming
CBSE SQPs



❖ Frequently Asked Questions	ix
❖ CBSE Board Exam 2026: Two-Exam Scheme Decoded	x–xi
❖ Instructions for Filling the OMR Sheet	xii–xiii
❖ Self Assessment Sheet	xiv–xvi
❖ Exam Ready: Answering Templates that Score	xvii–xix

I. Cheat Sheets

1. Real Numbers	1
2. Polynomials	2
3. Pair of Linear Equations in Two Variables	3
4. Quadratic Equations	4
5. Arithmetic Progressions	5
6. Triangles	6
7. Coordinate Geometry	7
8. Introduction to Trigonometry	8
9. Some Applications of Trigonometry	9
10. Circles	10
11. Areas Related to Circles	11
12. Surface Areas and Volumes	12
13. Statistics	13
14. Probability	14

II. 111 Most Probable Questions

15–23

III. Sample Question Papers

1. Sample Question Paper-1 (Easy)	25–33
2. Sample Question Paper-2 (Easy)	34–40
3. Sample Question Paper-3 (Easy)	41–45
4. Sample Question Paper-4 (Easy)	46–51

5. Sample Question Paper-5 (Medium)	52–59
6. Sample Question Paper-6 (Medium)	60–64
7. Sample Question Paper-7 (Medium)	65–70
8. Sample Question Paper-8 (Medium)	71–76
9. Sample Question Paper-9 (Hard)	77–85
10. Sample Question Paper-10 (Hard)	86–92
11. Sample Question Paper-11 (Hard)	93–100
12. Sample Question Paper-12 (Hard)	101–106

IV. Explanations

1. Sample Question Paper-1	109–119
2. Sample Question Paper-2	120–127
3. Sample Question Paper-3 (Handwritten through QR code)	128
4. Sample Question Paper-4 (Handwritten through QR code)	128
5. Sample Question Paper-5	129–140
6. Sample Question Paper-6	141–148
7. Sample Question Paper-7	149–156
8. Sample Question Paper-8 (Handwritten through QR code)	157
9. Sample Question Paper-9	158–170
10. Sample Question Paper-10	171–177
11. Sample Question Paper-11	178–185
12. Sample Question Paper-12 (Handwritten through QR code)	186

V. CBSE Solved Papers

1. CBSE Sample Question Paper (Issued by CBSE on 30 th July, 2025)	187–201
2. CBSE Solved Paper 2024	202–214
3. CBSE Solved Paper 2025	215–228

[CLICK HERE](#) To Discover more

Frequently Asked Questions



Scan for More FAQs

1

Question: Are the total number of questions, total marks and duration the same in CBSE SQP 2025-26 and 2025 Board Paper?

Answer: Yes. Both consist of 38 questions, carry a total of 80 marks, and have a duration of 3 hours.

2

Question: Is there any change in the assessment scheme for the current academic session (2025–26)?

Answer: No. There is no change in the assessment scheme for 2025–26. It remains the same as that of the academic session 2024–25.

3

Question: I have a doubt whether the pre board examinations marks would be considered in the board examinations?

Answer: No, the marks obtained in the pre-board examination are not added or included in the Board examination marks.

4

Question: If a choice is given to attempt any one of the questions in the Board exam, can we attempt both? If yes, which answer would be considered?

Answer: The instructions given in the question paper should be followed. Attempting both the options not only takes away much of the precious time but also confuses the examiner.

5

Question: Is it compulsory to write the answers in the same sequence as in the question paper?

Answer: No, you may attempt those questions in the beginning which you know best. Make sure that you write correct answer number to each question.

6

Question: Do examiners deduct marks for exceeding the word limit and spelling mistakes, especially in the language papers?

Answer: No marks are deducted for exceeding the word limit. Marks for spelling mistakes and other errors are deducted in the Language Papers.

7

Question: Will questions be asked from the Board's sample paper?

Answer: Sample question papers help you know the design, pattern and types of questions. Questions in the examination may be from any part of the syllabus. So, prepare thoroughly from the entire syllabus

8

Question: How can we obtain a copy of the Answers Book of Class 10th exam?

Answer: Applicant may apply for obtaining photocopy of answer books by paying prescribed processing charges as per time frame set by the Board. For details please see our website www.cbse.nic.in at the time of declaration of results.

CBSE Board Exam 2026: Two-Exam Scheme Decoded

1. What is the major change in Class X Board exams from 2026?

Ans: Starting in 2026, CBSE will conduct two Board exams per year for Class X, one main examination and one for improvement, if desired. This aims to offer students more flexibility and reduce pressure.

2. Why are two Board exams being introduced?

Ans: This is in line with the National Education Policy (NEP) 2020, which emphasizes holistic assessment, focus on core competencies, and reducing rote memorization.

Two Board exams aim to eliminate the high-stress/high-stakes nature of a single final exam and provide students more opportunities to improve.

3. Can I appear for both exams in the same year?

Ans. Yes, you can appear in both exams within the same school year:

First Board Examination (Main Exam)

You must appear in the first Board Examination, as it is mandatory for all students.

Eligible categories:

- ☐ Fresh students of Class X
- ☐ Students in Compartment (2nd Chance)
- ☐ Students repeating the year (Essential Repeat)
- ☐ Students appearing for improvement of previous performance

Second Board Examination

You can appear in the second examination in the following cases:

- ☐ Improvement: For up to 3 subjects to improve your score.
- ☐ Compartment: If you were placed in Compartment in the first phase exam.
- ☐ Improvement + Compartment: You can appear for both in May.
- ☐ Improvement for the students passed by the replacement of the subject.

Note: You are not allowed to take the second examination if you didn't appear in at least 3 subjects during the first examination. In such cases, you'll fall under the "Essential Repeat" category and have to wait until the next year.

4. When will the exams be held?

Ans. First Phase Examination: 17 February to 6 March 2026

Second Phase Examination: 5 May to 20 May 2026

5. Is it mandatory to attempt the First Phase exam for all students?

Ans. Yes, it is mandatory to attempt the First Phase Exam for all Class X students. It will be treated as the main board examination.

6. Is it mandatory to attempt the Second Phase exam? Who can appear for it?

Ans. No, the May exam is not mandatory. It is an optional attempt meant for:

- ☐ Students who want to improve their scores
- ☐ Students who were absent or could not perform well in the February exam
- ☐ Students who fail in one or more subjects in the first phase

7. Will the syllabus remain the same for both first and second examinations?

Ans. Yes, the syllabus will be the same for both the first and second examinations. Both examinations will be based on the full syllabus prescribed for the academic year.

8. Is it necessary to opt for the second examination at the time of filling the LOC for the first examination to be eligible for it?

Ans. Yes, you must opt for the second examination while filling the LOC (List of Candidates) for the first examination to be eligible for it.

As per CBSE policy:

- ☐ Filling the LOC for the first examination is mandatory.
- ☐ At that time, you must indicate whether you want to appear for the second examination.
- ☐ If you don't select this option, you cannot appear in the second examination later.
- ☐ No new name will be added to the LOC of the second examination.
- ☐ After the first exam result, you can opt out, but not opt in if you didn't choose the second examination earlier.

Tip: Always opt for the second examination—just in case.

9. Can I take admission in Class XI after the first examination result?

Ans. Yes, provisional admission to Class XI is allowed after the first examination result.

- ☐ Your performance of main/first examinations will be available in DigiLocker and can be used for admission to class XI if the student does not wish to appear in second examinations for improvement.
- ☐ Students not qualified in the main examination will be allowed provisional admission in Class XI and based on the result of the second examination, their admission will be confirmed.

10. Are the dates fixed for all subjects?

Ans. Major subjects like Maths, Science, Social Science, Hindi, and English will have fixed exam days.

Examination of Regional and Foreign Languages will be done in one go on a single day.

Examination of remaining subjects will be conducted 2 times to 3 times based on the choices of the students on 2 or 3 days.

11. Can I change my subjects after LOC Submission?

Ans. No. Once the List of Candidates (LOC) is submitted, no subject changes will be allowed except permitted as per policy.

12. Will special exams be conducted in case of emergencies?

Ans. No. Special exams will not be conducted under any circumstances.

13. When will the results be declared?

Ans. Results of the first examinations will be declared in the month of April.

Results of the second examinations will be declared in the month of June.

14. What details will be shown in the final Mark Sheet cum Passing Certificate?

Ans. The Mark Sheet cum Passing Certificate will include the following:

- ☐ Marks obtained in the first examination
- ☐ Marks obtained in the second examination (if attempted)
- ☐ Marks from the Practical/Internal Assessment
- ☐ Grades for each subject
- ☐ The better of the two marks (first or second examinations) will be clearly mentioned.

15. Will I get marksheets for both exams?

Ans. You'll receive your passing documents and merit certificates after the results of second examinations. Your first attempt's performance will be available in DigiLocker for Class XI admissions.

16. If I score well in the first examination, do I still need to appear in the second one?

Ans. No. If you're satisfied with your performance, you don't need to appear again. The second exam is optional for improvement.

17. Will Practical/Internal Assessment also be conducted twice?

Ans. No, Practical/Internal Assessment will be conducted only once.

EXAM READY: ANSWERING TEMPLATES THAT SCORE

Proving (Equation Based) Type

Q. If $\cos \theta + \sin \theta = 1$, when prove that $\cos \theta - \sin \theta = \pm 1$

Ans.

Given: It is given that $\cos \theta + \sin \theta = 1$.

To prove: _____

Explanation: Start by squaring both sides of the given equation $\cos \theta + \sin \theta = 1$.

Conclusion: Hence, $\cos \theta - \sin \theta =$ _____

Proving (Theorem/Concept Based) Type

Q. Prove that $\sqrt{3}$ is an irrational number.

Ans.

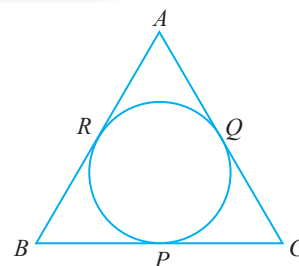
To prove: _____

Explanation: Assume that $\sqrt{3}$ is _____ and can be written as _____

Conclusion: Hence, $\sqrt{3}$ is _____

Q. Prove that the lengths of tangents drawn from an external point to a circle are equal.

Using above result, find the length BC of $\triangle ABC$. Given that, a circle is inscribed in $\triangle ABC$ touching the sides AB , BC and CA at R , P and Q respectively and $AB = 10$ cm, $AQ = 7$ cm, $CQ = 5$ cm.



Ans.

Given: $AB =$ _____ cm, $AQ =$ _____ cm, $CQ =$ _____ cm.

To find: _____

Explanation: Start by using the property that the lengths of tangents drawn from an _____ to a circle are _____

Conclusion: Hence, the length of BC is _____

Evaluation Type

- Q.** The minute hand of a wall clock is 18 cm long. Find the area of the face of the clock described by the minute hand in 35 minutes.

Ans.

Given: Length of the minute hand = 18 cm, Time interval = 35 minutes

To find: _____

Construct the diagram: First, we will draw the circle representing the clock face.

Explanation: Indicate the position of the minute hand at the start and after 35 minutes.

Conclusion: The area described by the minute hand is _____ cm^2 .

- Q.** A boy whose eye level is 1.35 m from the ground, spots a balloon moving with the wind in a horizontal line at some height from the ground. The angle of elevation of the balloon from the eyes of the boy at an instant is 60° . After 12 seconds, the angle of elevation reduces to 30° . If the speed of the wind is 3 m/s then find the height of the balloon from the ground. (Use $\sqrt{3} = 1.73$)

Ans.

Given: Eye level height: 1.35 m, Speed of the wind: 3 m/s, Initial angle of elevation = 60° & Final angle of elevation = 30°

To find: _____

Construct the diagram: First, we will draw the positions of the boy's eye level and the balloon. Mark the angles of elevation.

Explanation: Now, we will apply the trigonometric ratios

Conclusion: The height of the balloon from the ground is _____ m.

Case-Based

- Q.** Ms. Sheela visited a store near her house and found that the glass jars are arranged one above the other in a specific pattern. On the top layer there are 3 jars. In the next layer there are 6 jars. In the 3rd layer from the top there are 9 jars and so on till the 8th layer.

On the basis of the above situation answer the following questions.

- (i) Write an A.P whose terms represent the number of jars in different layers starting from top. Also, find the common difference. 1
- (ii) Is it possible to arrange 34 jars in a layer if this pattern is continued? Justify your answer. 1
- (iii) (a) If there are 'n' number of rows in a layer then find the expression for finding the total number of jars in terms of n . Hence find S_8 . 2

OR

- (iii) (b) The shopkeeper added 3 jars in each layer. How many jars are there in the 5 th layer from the top? 2

Ans.

(i) **Given:** The number of jars in each layer forms a pattern: _____

To find: _____

Explanation: Start with the first term as _____, and notice that each successive term increases by a fixed number.

Conclusion: The A.P. is _____ and the common difference is _____.

(ii) **Given:** The number of jars in each layer increases following an arithmetic progression.

To find: _____

Explanation: Assume the total number of jars in the n-th layer can be calculated using the general term of the A.P.

Conclusion: Therefore, it is _____

(iii) (a) **Given:** The arithmetic progression _____ and its common difference _____

To find: _____

Explanation: Use the formula for the sum of an arithmetic progression.

Conclusion: Therefore, the total number number of jars is _____

OR

(b) **Given:** An additional 3 jars are added to each layer.

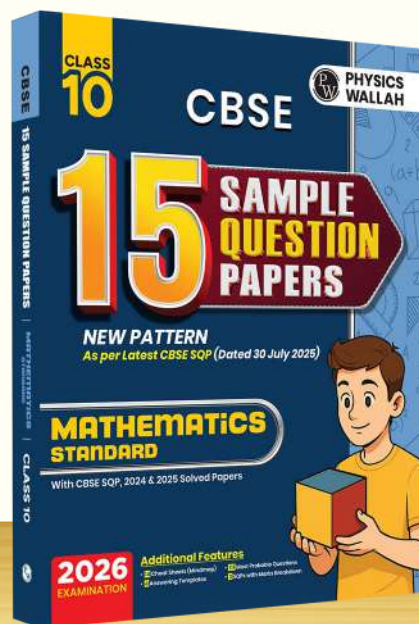
To find: _____

Explanation: Calculate the number of jars in the 5th layer using the given pattern.

Conclusion: Therefore, the number of jars in the 5th layer is _____

Class 10 Ki Taiyaari Ho Ab Aur Bhi Aasan!

- 1 Topper's Explanations
- 2 Mistake 101: What not to do!
- 3 Self Assessment Sheet
- 4 Frequently Asked Questions
- 5 CBSE Solved Papers 2024 & 2025
- 6 Answer Writing & OMR Filling Tips
- 7 CBSE Past 5 Years' Paper Trend Analysis
- 8 Cheat Sheets (Mind Maps)
- 9 111 Most Probable Questions
- 10 Level-wise (Easy, Medium, Hard) Sample Papers
- 11 CBSE Board Exam 2026: Two-Exam Scheme Decoded
- 12 8 Sample Papers with detailed explanations (Step-wise Marking)
- 13 4 Sample Papers with handwritten explanations through QR code
- 14 Question Typology, Evolving Trends in CBSE Exam Patterns, Preparation Guide
- 15 CBSE Sample Question Paper 2025-26 (with CBSE Marking Scheme)



AVAILABLE ON GIVEN LINKS



Amazon Link

PW Store Link



CHAPTER-1

REAL NUMBERS

To Access One
Shot Revision Video
Scan This QR Code



Cheat Sheet

The Fundamental Theorem of Arithmetic:

- Every composite number can be expressed (factorized) as a product of primes, and this factorisation is unique, apart from the order in which the prime factors occur.

Note: Fundamental theorem of arithmetic is called a Unique Factorisation Theorem.

Composite number = Product of prime numbers.

e.g. $\therefore 24 = 2 \times 2 \times 2 \times 3$

$= 2^3 \times 3$, where 2 and 3 are prime numbers

Theorems:

- Theorem 1:** Let p be a prime number. If p divides a^2 , then p divides a , where a is a positive integer.

- Theorem 2:** $\sqrt{2}$ is an irrational number.

Note: Square root of any prime number is always an irrational number

CBSE 2025, 2024, 2023, 2020, 2019

Irrational Numbers:

It cannot be expressed as $x = \frac{p}{q}$, $q \neq 0$. where p and q are integers.

e.g.: $\sqrt{2}, \sqrt{3}, \pi, \dots$

CBSE 2025, 2024, 2023, 2022 Term-I, 2020, 2019

Prime Factorisation Method:

Prime Factorisation is a way of representing a number as a product of its prime factors. It is also used to find out the H.C.F and L.C.M.

For any two positive integers a and b we have,

$\text{H.C.F}(a, b) \times \text{L.C.M}(a, b) = a \times b$

e.g.: Find H.C.F of 24 and 36.

Prime factors of 24 : $2^3 \times 3^1$

Prime factors of 36 : $2^2 \times 3^2$

$\text{H.C.F} = 2^2 \times 3^1 = 12$

e.g.: Find L.C.M of 12 and 18.

Prime factors of 12 : $2^2 \times 3^1$

Prime factors of 18 : $2^1 \times 3^2$

$\text{L.C.M} = 2^2 \times 3^2 = 36$

CBSE 2020

Prime Number:

Prime numbers are natural numbers that are divisible by only 1 and the number itself.
e.g. 2, 3, 5, 7, 11, 13,....

CBSE 2024

Composite Number:

Composite numbers are numbers that have more than two factors.
e.g. 4, 6, 8, 9, 10, 12,....

CBSE 2022 Term-I

Co-prime Number:

Co-prime numbers are two pairs of numbers which have a common factor of 1.
e.g. (14,15), (1,99), (8,15)

Rational Numbers:

It can be expressed as $x = \frac{p}{q}$, $q \neq 0$. where p and q are integers.

e.g.: $\frac{1}{4}, \frac{2}{3}, 2, \dots$

Integers 'Z' or 'I':

Integers include all whole numbers and negative numbers.

e.g.: $\dots -3, -2, -1, 0, 2, 3, \dots$

Negative Integer:

e.g.: $-1, -2, -3, \dots$

Whole Number 'W':

The whole number which includes all the non-negative integers.

$W: 0, 1, 2, 3, \dots$

Zero

Natural Number 'N':

Natural numbers are all positive integers
 $N: 1, 2, 3, \dots$

Real Numbers

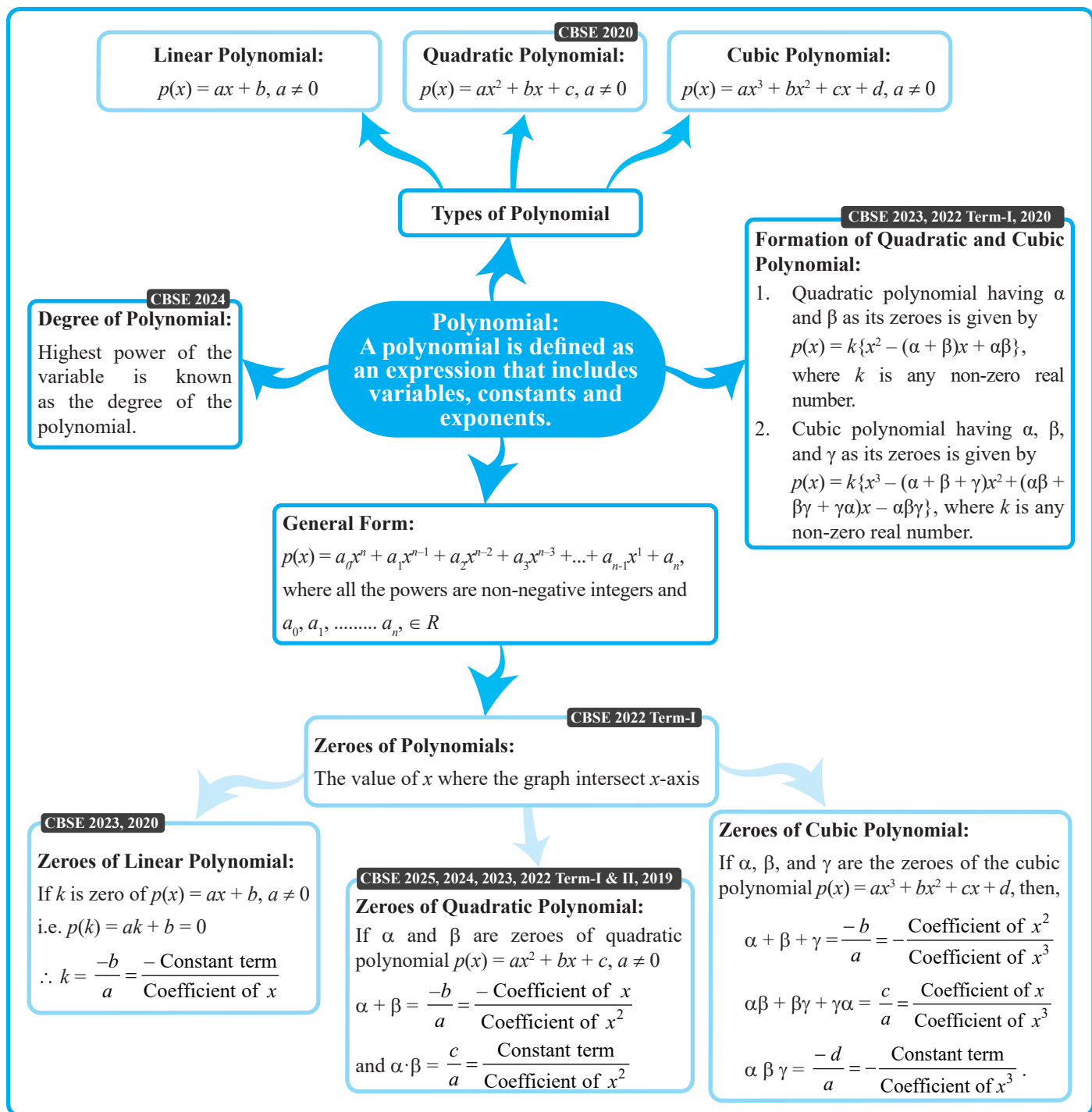
CHAPTER-2

POLYNOMIALS



Cheat Sheet

To Access One
Shot Revision Video
Scan This QR Code



CHAPTER-3

PAIR OF LINEAR EQUATIONS IN TWO VARIABLES



Cheat Sheet

To Access One
Shot Revision Video
Scan This QR Code



CBSE 2025, 2024, 2019

Substitution Method:

To find the solution using this method we substitute value of one variable (in terms of another variable) from one equation to another equation.

Example: $7x - 15y = 2$... (i)
 $x + 2y = 3$... (ii)

Sol. From equation (ii), $x = 3 - 2y$... (iii)

Substitute value of x in eq. (i)

$$7(3 - 2y) - 15y = 2$$

$$-29y = -19 \Rightarrow y = \frac{19}{29}$$

$$\therefore \text{In eq. (iii)} x = 3 - 2\left(\frac{19}{29}\right) = \left(\frac{49}{29}\right)$$

Definition: A collection of two linear equations in the same two variables.

Solution:

CBSE 2019

The value of the two variables which satisfy both the linear equations in the two variables

Algebraic Method

Pair of Linear Equations in Two Variables

Graphical Representation and Nature of equations/solutions

CBSE 2024, 2023, 2022 Term-I, 2019

Elimination Method:

To find the solution using this method we eliminate one of the variables by adding/subtracting both equation after, if necessary, multiplying the equation by appropriate numbers.

Example: $2x + 3y = 8$... (i)
 $4x + 6y = 7$... (ii)

Sol. From equation (i) $\times 2$ - eq. (ii) $\times 1$, we have

$$(4x - 4x) + (6y - 6y) = 16 - 7$$

$$0 = 9, \text{ which is a false statement}$$

The pair of equation has no solution

General Form:

$$a_1x + b_1y + c_1 = 0, a_2x + b_2y + c_2 = 0$$

Where, a_1, a_2, a_3, b_1, b_2 & b_3 are real numbers such that

a_1 & b_1 and a_2 & b_2 can not be equal to zero simultaneously.

S. No.	Pair of Lines	$\frac{a_1}{a_2}$	$\frac{b_1}{b_2}$	$\frac{c_1}{c_2}$	Compare the Ratios	Graphical Representation	Algebraic Interpretation
1.	$x - 2y = 0$ $3x + 4y - 20 = 0$	$\frac{1}{3}$	$-\frac{2}{4}$	$\frac{0}{-20}$	$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$		CBSE 2024, 2020 Exactly one solution-consistent (Unique)
2.	$2x + 3y - 9 = 0$ $4x + 6y - 18 = 0$	$\frac{2}{4}$	$\frac{3}{6}$	$\frac{-9}{-18}$	$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$		CBSE 2025, 2023, 2019 Infinitely many solutions-consistent (Dependent)
3.	$x + 2y - 4 = 0$ $2x + 4y - 12 = 0$	$\frac{1}{2}$	$\frac{2}{4}$	$\frac{-4}{-12}$	$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$		CBSE 2024, 2022 Term-I No solutions-Inconsistent

CLICK HERE

To Discover more

CHAPTER-4

QUADRATIC EQUATIONS

To Access One
Shot Revision Video
Scan This QR Code



Cheat Sheet

CBSE 2025, 2024, 2023, 2022 Term-I & II, 2020, 2019

Factorisation Method:

In this method ($ax^2 + bx + c = 0$) can be expressible as the product of two linear expressions, say $(px + q)$ and $(rx + s)$, where p, q, r are real numbers such that $p \neq 0, r \neq 0$.

Then $ax^2 + bx + c = 0 \Rightarrow (px + q)(rx + s) = 0$

$(px + q) = 0$ or $(rx + s) = 0 \Rightarrow x = \frac{-q}{p}$ or $x = \frac{-s}{r}$

CBSE 2025, 2024, 2020

Quadratic Formula:

For $ax^2 + bx + c = 0, D = b^2 - 4ac,$

$$x = \frac{-b \pm \sqrt{D}}{2a}$$

Method of Finding Solution

CBSE 2022 Term-II

An equation of the form $ax^2 + bx + c = 0$ where a, b, c are real numbers and $a \neq 0$, is called a quadratic equation in x .

Solution of Roots of Quadratic Equation:

A real number α is called a root of the quadratic equation $ax^2 + bx + c = 0, a \neq 0$ if $a\alpha^2 + b\alpha + c = 0$.

Quadratic Equation

CBSE 2020

Application:

- ☐ Speed = $\frac{\text{Distance}}{\text{Time}}$
- ☐ Area of figures
- ☐ Volume of water = flow rate $\times$ time
- ☐ Number of ages

CBSE 2019

Nature of roots:

$ax^2 + bx + c = 0, a \neq 0$, where $D = (b^2 - 4ac)$ and the roots are given by $\alpha = \frac{-b + \sqrt{D}}{2a}$ and $\beta = \frac{-b - \sqrt{D}}{2a}$

CBSE 2019

Case III:

When $D < 0$, roots are imaginary.

CBSE 2023

Case I:

When $D > 0$, roots are real, distinct and given by

$$\alpha = \frac{-b + \sqrt{D}}{2a} \text{ and } \beta = \frac{-b - \sqrt{D}}{2a}$$

CBSE 2025, 2024, 2023, 2022 Term-II, 2019

Case II:

When $D = 0$, roots are real and equal and roots are

$$\text{given by } \alpha = \frac{-b}{2a} \text{ and } \beta = \frac{-b}{2a}$$

111 MOST PROBABLE QUESTIONS (ANALYZED & SELECTED FROM PYQs)

To Access Detailed Explanations
Scan This QR Code



Note: Questions in this section are selected based on repetitive themes and concepts from past examinations, though patterns and typologies may vary.

1. Real Numbers

1. If two positive integers p and q can be expressed as $p = 18a^2b^4$ and $q = 20a^3b^2$, where a and b are prime numbers, then LCM (p, q) is; **(1 M) (2024)**

(a) $2a^2b^2$ (b) $180a^2b^2$
(c) $12a^2b^2$ (d) $180a^3b^4$

2. If the HCF (2520, 6600) = 40 and LCM (2520, 6600) = $252 \times k$, then the value of k is **(1 M) (2024)**

(a) 1650 (b) 1600
(c) 165 (d) 1625

3. The exponent of 5 in the prime factorisation of 3750 is:

(1 M) (2022 Term-I)

(a) 3 (b) 4 (c) 5 (d) 6

4. Three alarm clocks ring their alarms at regular intervals of 20 min, 25 min and 30 min respectively. If they first beep together at 12 noon, at what time will they beep again for the first time? **(1 M) (2022 Term-I)**

(a) 4:00 pm (b) 4:30 pm
(c) 5:00 pm (d) 5:30 pm

5. Prove that $5 - 2\sqrt{3}$ is an irrational number. It is given that $\sqrt{3}$ is an irrational number. **(2 M) (2024)**

6. Find the LCM and HCF of 72 and 120. **(2 M) (2023)**

7. Prove that $\sqrt{5}$ is an irrational number. **(3 M) (2024)**

8. Prove that $\sqrt{2}$ is an irrational number. **(3 M) (2025)**

2. Polynomials

9. If α and β are zeroes of the polynomial $2x^2 - 9x + 5$, then value of $\alpha^2 + \beta^2$ is **(1 M) (2024)**

(a) $\frac{1}{4}$ (b) $\frac{61}{4}$ (c) 1 (d) $\frac{71}{4}$

10. If α, β are the zeroes of the polynomial $p(x) = 4x^2 - 3x - 7$, then $\left(\frac{1}{\alpha} + \frac{1}{\beta}\right)$ is equal to: **(1 M) (2023)**

(a) $\frac{7}{3}$ (b) $-\frac{7}{3}$ (c) $\frac{3}{7}$ (d) $-\frac{3}{7}$

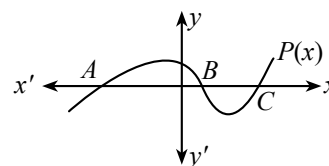
11. If one zero of the polynomial $x^2 + 3x + k$ is 2, then the value of k . **(1 M) (2023)**

(a) -10 (b) 10 (c) 5 (d) -5

12. If the zeroes of the quadratic polynomial $x^2 + (a+1)x + b$ are 2 and -3, then **(1 M) (2023)**

(a) $a = -7, b = -1$ (b) $a = 5, b = -1$
(c) $a = 2, b = -6$ (d) $a = 0, b = -6$

13. In figure, the graph of a polynomial $P(x)$ is shown. The number of zeroes of $P(x)$ is **(1 M) (2022 Term-I)**

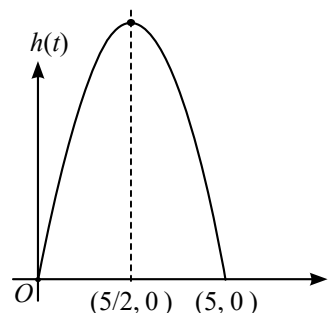


(a) 1 (b) 2 (c) 3 (d) 4

14. Find a quadratic polynomial, the sum and product of whose zeroes are 0 and $-\frac{3}{5}$ respectively. Hence find the zeroes. **(3 M) (2016 Term-I)**

15. α and β are zeroes of a quadratic polynomial $px^2 + qx + 1$. Form a quadratic polynomial whose zeroes are $\frac{2}{\alpha}$ and $\frac{2}{\beta}$. **(3 M) (2025)**

16. A ball is thrown in the air so that t seconds after it is thrown, its height H metre above its starting point is given by the polynomial $h = 25t - 5t^2$. **(2024)**



Observe the graph of the polynomial and answer the following questions:

- (i) Write zeroes of the given polynomial. (1 M)
- (ii) Find the maximum height achieved by ball. (1 M)
- (iii) (a) After throwing upward, how much time did the ball take to reach to the height of 30 m? (2 M)

OR

- (iii) (b) Find the two different values of t when the height of the ball was 20 m. (2 M)

3. Pair of Linear Equations in Two Variables

17. The value of k for which the system of equations $3x - y + 8 = 0$ and $6x - ky + 16 = 0$ has infinitely many solutions, is (1 M) (2024)

- (a) -2 (b) 2 (c) $\frac{1}{2}$ (d) $-\frac{1}{2}$

18. The value of k for which the system of linear equations $x + 2y = 3$, $5x + ky + 7 = 0$ is inconsistent is (1 M) (2020)

- (a) $-\frac{14}{3}$ (b) $\frac{2}{5}$ (c) 5 (d) 10

19. Find the value of k for which the following pair of linear equations have infinitely many solutions. $2x + 3y = 7$, $(k+1)x + (2k-1)y = 4k+1$. (2 M) (2019)

20. A fraction becomes $\frac{1}{3}$ when 2 is subtracted from the numerator and it becomes $\frac{1}{2}$ when 1 is subtracted from the denominator. Find the fraction. (3 M) (2019)

21. The sum of the digits of a two digit number is 8 and the difference between the number and that formed by reversing the digits is 18. Find the number. (3 M) (2016 Term-I)

22. The monthly incomes of two persons are in the ratio $9 : 7$ and their monthly expenditures are in the ratio $4 : 3$. If each saved ₹5,000, express the given situation algebraically as a system of linear equations in two variables. Hence, find their respective monthly incomes. (3 M) (2025)

23. Two schools 'P' and 'Q' decided to award prizes to their students for two games of Hockey ₹ x per student and Cricket ₹ y per student. School 'P' decided to award a total of ₹ 9,500 for the two games to 5 and 4 students respectively; while school 'Q' decided to award ₹ 7,370 for the two games to 4 and 3 students respectively.

Based on the above information, answer the following questions: (2023)



- (i) Represent the following information algebraically (in terms of x and y). (1 M)
- (ii) (a) What is the prize amount for hockey? (2 M)

OR

- (b) Prize amount on which game is more and by how much?
- (iii) What will be the total prize amount if there are 2 students each from two games? (1 M)

4. Quadratic Equations

24. If the quadratic equation $ax^2 + bx + c = 0$ has two real and equal roots, then 'c' is equal to: (1 M) (2023)

- (a) $\frac{-b}{2a}$ (b) $\frac{b}{2a}$ (c) $\frac{-b^2}{4a}$ (d) $\frac{b^2}{4a}$

25. Solve the quadratic equation: $x^2 - 2ax + (a^2 - b^2) = 0$ for x . (2 M) (2022 Term-II)

26. Solve for x : $\sqrt{2x+9} + x = 13$ (2 M) (2016 Term-II)

27. Find the value of 'p' for which the quadratic equation $p(x-4)(x-2) + (x-1)^2 = 0$ has real and equal roots. (3 M) (2022 Term-II)

28. A train covers a distance of 480 km at a uniform speed. If the speed had been 8 km/h less, then it would have taken 3 hours more to cover the same distance. Find the original speed of the train. (3 M) (2020)

29. The total cost of a certain length of a piece of cloth is ₹ 200. If the piece was 5 m longer and each metre of cloth costs ₹ 2 less, the cost of the piece would have remained unchanged. How long is the piece and what is its original rate per metre? (4 M) (2019)

30. Solve for x : $\frac{1}{2x-3} + \frac{1}{x-5} = 1\frac{1}{9}$, $x \neq \frac{3}{2}, 5$ (4 M) (2017)

31. Express the equation $\frac{x-2}{x-3} + \frac{x-4}{x-5} = \frac{10}{3}$; ($x \neq 3, 5$) as a quadratic equation in standard form. Hence, find the roots of the equation so formed. **(5 M) (2025)**

5. Arithmetic Progressions

32. In an A.P., if the first term $a = 7$, n^{th} term, $a_n = 84$ and the sum of first n terms $S_n = \frac{2093}{2}$, then n is equal to: **(1 M) (2024)**
- (a) 22 (b) 24 (c) 23 (d) 26
33. Which term of the A.P. $-29, -26, -23, \dots, 61$ is 16? **(1 M) (2024)**
- (a) 11^{th} (b) 16^{th} (c) 10^{th} (d) 31^{st}
34. Which term of the A.P. $-\frac{11}{2}, -3, -\frac{1}{2}, \dots$ is $\frac{49}{2}$? **(2 M) (2022 Term-II)**
35. If in an A.P., the sum of first m terms is n and the sum of its first n terms is m , then prove that the sum of its first $(m + n)$ terms is $-(m + n)$. **(3 M) (2020)**
36. If the m^{th} term of an A.P. is $\frac{1}{n}$ and n^{th} term is $\frac{1}{m}$ then show that its $(mn)^{\text{th}}$ term is 1. **(3 M) (2017)**
37. The sum of four consecutive numbers in an AP is 32 and the ratio of the product of the first and the last term to the product of two middle terms is 7 : 15. Find the numbers. **(4 M) (2018)**
38. Find the sum of integers between 100 and 200 which are (i) divisible by 9 (ii) not divisible by 9. **(5 Marks) (2023)**
39. Cable cars at hill stations are one the major attractions. On a hill station, the length of cable car ride from base point to top most point on the hill is 5000 m. Poles are installed at equal intervals on the way to provide support to the cables on which car moves.



The distance of first pole from base point is 200 m and subsequent poles are installed at equal interval of 150 m. Further, the distance of last pole from the top is 300 m. Based on above information, answer the following questions using Arithmetic Progression: **(2025)**

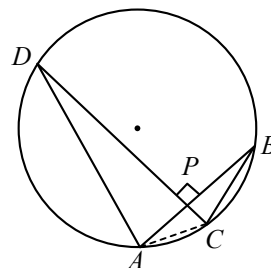
- (i) Find the distance of 10^{th} pole from the base. **(1 M)**
- (ii) Find the distance between 15^{th} pole and 25^{th} pole. **(1 M)**
- (iii) (a) Find the time taken by cable car to reach 15^{th} pole from the top if it is moving at the speed of 5 m/sec and coming from top. **(2 M)**

OR

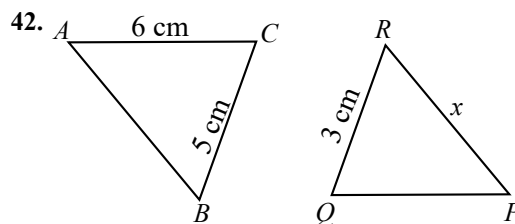
- (iii) (b) Find the total number of poles installed along the entire journey. **(2 M)**

6. Triangles

40. AB and CD are two chords of a circle intersecting at P . Choose the correct statement from the following: **(1 M) (2024)**

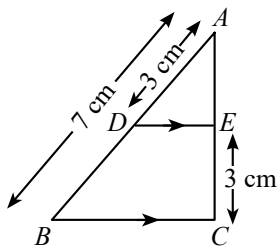


- (a) $\triangle ADP \sim \triangle CBA$ (b) $\triangle ADP \sim \triangle BPC$
- (c) $\triangle ADP \sim \triangle BCP$ (d) $\triangle ADP \sim \triangle CBP$
41. The perimeters of two similar triangles ABC and PQR are 56 cm and 48 cm respectively, PQ/AB is equal to **(1 M) (2024)**
- (a) $\frac{7}{8}$ (b) $\frac{6}{7}$ (c) $\frac{7}{6}$ (d) $\frac{8}{7}$



In the given figure, $\triangle ABC \sim \triangle QPR$, If $AC = 6$ cm, $BC = 5$ cm, $QR = 3$ cm and $PR = x$; then the value of x is: **(1 M) (2023)**

- (a) 3.6 cm (b) 2.5 cm
- (c) 10 cm (d) 3.2 cm
43. In the given figure, $DE \parallel BC$. If $AD = 3$ cm, $AB = 7$ cm and $EC = 3$ cm, then the length of AE is: **(1 M) (2023)**



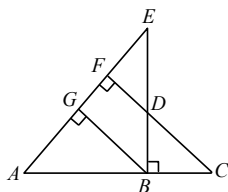
- (a) 2 cm (b) 2.25 cm
(c) 3.5 cm (d) 4 cm

44. In $\triangle DEW$, $AB \parallel EW$. If $AD = 4$ cm, $DE = 12$ cm and $DW = 24$ cm, then find the value of DB .

(1 M) (2016 Term-I)

45. In given figure, $EB \perp AC$, $BG \perp AE$ and $CF \perp AE$. Prove that:

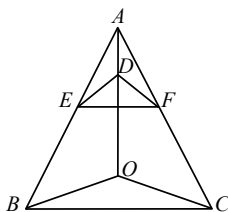
(3 M) (2016 Term-I)



- (i) $\triangle ABG \sim \triangle DCB$ (ii) $\frac{BC}{BD} = \frac{BE}{BA}$

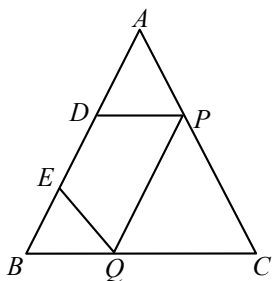
46. In the figure if $DE \parallel OB$ and $EF \parallel BC$, then prove that $DF \parallel OC$.

(3 M) (2015 Term-I)



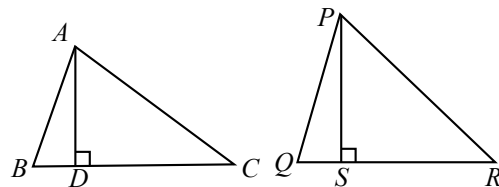
47. In the figure, there are two points D and E on side AB of $\triangle ABC$ such that $AD = BE$. If $DP \parallel BC$ and $EQ \parallel AC$, then prove that $PQ \parallel AB$.

(4 M) (2015 Term-I)



48. The corresponding sides of $\triangle ABC$ and $\triangle PQR$ are in the ratio 3 : 5. $AD \perp BC$ and $PS \perp QR$ as shown in the following figures:

(5 M) (2025)



- (i) Prove that $\triangle ADC \sim \triangle PSR$
(ii) If $AD = 4$ cm, find the length of PS .
(iii) Using (ii) find ar $(\triangle ABC)$: ar $(\triangle PQR)$

7. Coordinate Geometry

49. The distance of the point $(-4, 3)$ from y -axis is:

(1 M) (2023)

- (a) -4 (b) 4 (c) 3 (d) 5

50. Find the coordinates of a point A , where AB is a diameter of the circle with centre $(-2, 2)$ and B is the point with coordinates $(3, 4)$.

(1 M) (2019)

51. Find the ratio in which the point $P\left(\frac{3}{4}, \frac{5}{12}\right)$ divides the line segment joining the points $A\left(\frac{1}{2}, \frac{3}{2}\right)$ and $B(2, -5)$.

(2 M) (2015 Term-II)

52. Find the coordinates of the point C which lies on the line AB produced such that $AC = 2BC$, where coordinates of points A and B are $(-1, 7)$ and $(4, -3)$ respectively.

(2 M) (2025)

53. Find the ratio in which the point $\left(\frac{8}{5}, y\right)$ divides the line segment joining the points $(1, 2)$ and $(2, 3)$. Also, find the value of y .

(3 M) (2024)

54. The line segment joining the points $A(2, 1)$ and $B(5, -8)$ is trisected at the points P and Q such that P is nearer to A . If P also lies on the line given by $2x - y + k = 0$, find the value of k .

(3 M) (2019)

55. If the point $P(x, y)$ is equidistant from the points $A(a + b, b - a)$ and $B(a - b, a + b)$. Prove that $bx = ay$.

(3 M) (2016 Term-II)

56. Find the coordinates of a point P on the line segment joining $A(1, 2)$ and $B(6, 7)$ such that $AP = \frac{2}{5} AB$.

(3 M) (2015 Term-II)

8. Introduction to Trigonometry

57. If $2\sin(A + B) = \sqrt{3}$ and $\cos(A - B) = 1$, then find the measures of angles A and B . $0 \leq A, B, (A + B) \leq 90^\circ$.

(2 M) (2024)

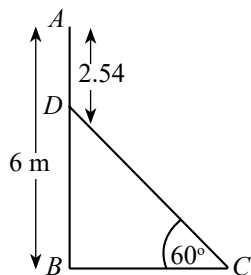
58. Prove that $\frac{\sin A - 2\sin^3 A}{2\cos^3 A - \cos A} = \tan A$

(3 M) (2023)

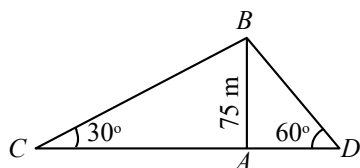
59. If $\sin \theta + \cos \theta = p$ and $\sec \theta + \operatorname{cosec} \theta = q$, then prove that $q(p^2 - 1) = 2p$. (3 M) (2023)
60. Prove that: $2(\sin^6 \theta + \cos^6 \theta) - 3(\sin^4 \theta + \cos^4 \theta) + 1 = 0$. (3 M) (2020)
61. Find A and B if $\sin(A + 2B) = \frac{\sqrt{3}}{2}$ and $\cos(A + 4B) = 0$, where A and B are acute angles. (3 M) (2019)
62. If $4 \tan \theta = 3$, evaluate $\left(\frac{4 \sin \theta - \cos \theta + 1}{4 \sin \theta + \cos \theta - 1} \right)$ (3 M) (2018)
63. Prove that $\frac{\cos A + \sin A - 1}{\cos A - \sin A + 1} = \operatorname{cosec} A - \cot A$ (3 M) (2025)
64. Prove that $\frac{\tan^2 A}{\tan^2 A - 1} + \frac{\operatorname{cosec}^2 A}{\sec^2 A - \operatorname{cosec}^2 A} = \frac{1}{1 - 2 \cos^2 A}$ (4 M) (2019)
65. Prove that: $\frac{\sin A + \cos A}{\sin A - \cos A} + \frac{\sin A - \cos A}{\sin A + \cos A} = \frac{2}{1 - 2 \cos^2 A}$ (4 M) (2016 Term-I)

9. Some Applications of Trigonometry

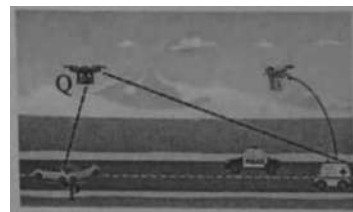
66. If a pole 6 m high casts a shadow $2\sqrt{3}$ m long on the ground, then sun's elevation is: (1 M) (2023)
(a) 60° (b) 45° (c) 30° (d) 90°
67. In Fig., AB is a 6 m high pole and CD is a ladder inclined at an angle of 60° to the horizontal and reaches up to a point D of pole. If $AD = 2.54$ m, find the length of the ladder. (Use $\sqrt{3} = 1.73$) (1 M) (2016 Term-II)



68. Two men on either side of a cliff 75 m high observe the angles of elevation of the top of the cliff to be 30° and 60° . Find the distance between the two men. (3 M) (2022 Term-II)



69. There is a small island in the middle of a 100 m wide river and a tall tree stands on the island. P and Q are points directly opposite to each other on two banks and in line with the tree. If the angles of elevation of the top of the tree from P and Q are respectively 30° and 45° , find the height of the tree. (Use $\sqrt{3} = 1.732$) (3 M) (2022 Term-II)
70. The angles of depression of the top and bottom of a 50 m high building from the top of a tower are 45° and 60° respectively. Find the height of the tower and the horizontal distance between the tower and the building. (use $\sqrt{3} = 1.73$) (3 M) (2016 Term-II)
71. A man observes a car from the top of a tower, which is moving towards the tower with a uniform speed. If the angle of depression of the car changes from 30° to 45° in 12 minutes, find the time taken by the car now to reach the tower. (4 M) (2017)
72. At a point A , 20 metres above the level of water in a lake, the angle of elevation of a cloud is 30° . The angle of depression of the reflection of the cloud in the lake, at A is 60° . Find the distance of the cloud from A . (4 M) (2015 Term-II)
73. A drone was used to facilitate movement of an ambulance on the straight highway to a point P on the ground where there was an accident. The ambulance was travelling at the speed of 60 km/h. The drone stopped at a point Q , 100 m vertically above the point P . The angle of depression of the ambulance was found to be 30° at a particular instant.



Based on above information, answer the following questions: (2025)

- (i) Represent the above situation with the help of a diagram. (1 M)
- (ii) Find the distance between the ambulance and the site of accident (P) at the particular instant.
(Use $\sqrt{3} = 1.73$) (1 M)
- (iii) (a) Find the time (in seconds) in which the angle of depression changes from 30° to 45° . (2 M)

OR

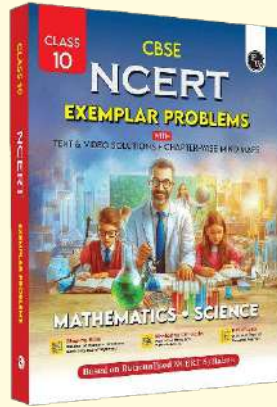
- (iii) (b) How long (in seconds) will the ambulance take to reach point P from a point T on the highway such that angle of depression of the ambulance at T is 60° from the drone? (2 M)

The Must-Have Books for Conquering **Board Exams**



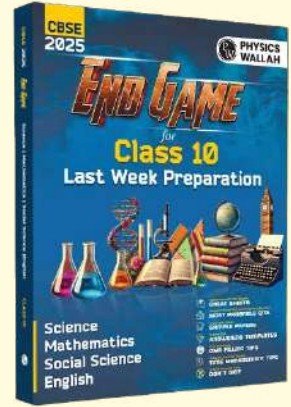
Amazon Link

PW Store Link



Amazon Link

PW Store Link



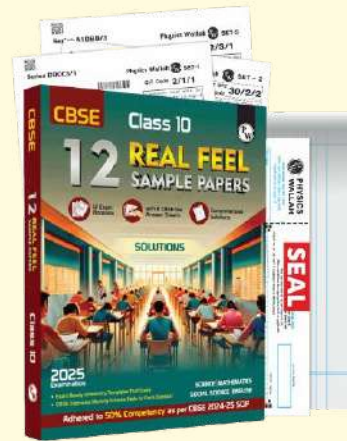
Amazon Link

PW Store Link



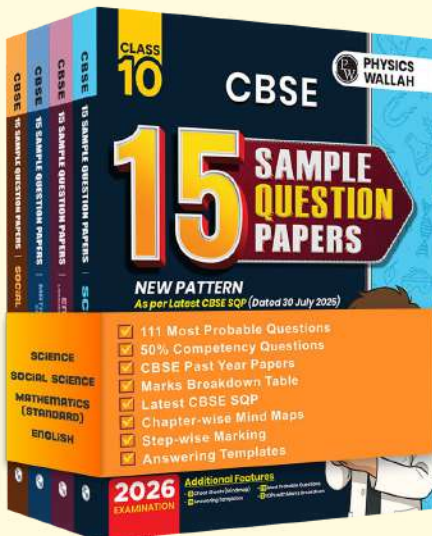
Amazon Link

PW Store Link



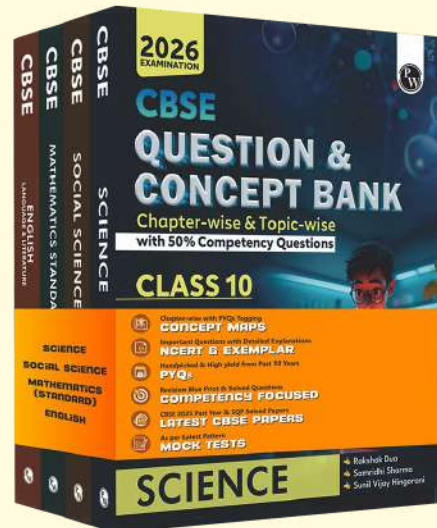
Amazon Link

PW Store Link



Amazon Link

PW Store Link



Amazon Link

PW Store Link



CBSE SAMPLE QUESTION PAPER

(Issued by CBSE on 30th July, 2025)

Class-X Session: 2025-26

MATHEMATICS STANDARD (041)

Time : 3 hours

Maximum Marks : 80

GENERAL INSTRUCTIONS:

Read the following instructions carefully and follow them:

- (i) This question paper contains 38 questions. All Questions are compulsory.
- (ii) This Question Paper is divided into 5 Sections A, B, C, D and E.
- (iii) In Section A, Question numbers 1-18 are multiple choice questions (MCQs) and questions no. 19 and 20 are Assertion- Reason based questions of 1 mark each.
- (iv) In Section B, Question numbers 21-25 are very short answer (VSA) type questions, carrying 02 marks each.
- (v) In Section C, Question numbers 26-31 are short answer (SA) type questions, carrying 03 marks each.
- (vi) In Section D, Question numbers 32-35 are long answer (LA) type questions, carrying 05 marks each.
- (vii) In Section E, Question numbers 36-38 are case study-based questions carrying 4 marks each with sub parts of the values of 1, 1 and 2 marks each respectively.
- (viii) There is no overall choice. However, an internal choice in 2 questions of Section B, 2 questions of Section C and 2 questions of Section D has been provided. An internal choice has been provided in all the 2 marks questions of Section E.
- (xi) Draw neat and clean figures wherever required. Take $\pi = 22/7$ wherever required if not stated.
- (x) Use of calculators is not allowed.

SECTION - A

Section A consists of 20 questions of 1 mark each.

1. If $a = 2^2 \times 3^x$, $b = 2^2 \times 3 \times 5$, $c = 2^2 \times 3 \times 7$ and $\text{LCM}(a, b, c) = 3780$, then x is equal to (1 M)
(a) 1 (b) 2 (c) 3 (d) 0

- Sol. (c) $\text{LCM}(a, b, c) = 2^2 \times 3^x \times 5 \times 7 = 3780$
 $140 \times 3^x = 3780$
 $3^x = 27 = 3^3$
 $x = 3$ (1 M)

2. The shortest distance (in units) of the point (2, 3) from y-axis is (1 M)
(a) 2 (b) 3 (c) 5 (d) 1

- Sol. (a) As shortest distance from (2, 3) to y-axis is the x coordinate, i.e., 2. (1 M)

3. If the lines given by $3x + 2ky = 2$ and $2x + 5y + 1 = 0$ are not parallel, then k has to be (1 M)
(a) $\frac{15}{4}$ (b) $\neq \frac{15}{4}$
(c) any rational number (d) any rational number having 4 as denominator

- Sol. (b) $\frac{3}{2} \neq \frac{2k}{5}$, hence $k \neq \frac{15}{4}$ (1 M)

4. A quadrilateral ABCD is drawn to circumscribe a circle. If $BC = 7\text{cm}$, $CD = 4\text{cm}$ and $AD = 3\text{cm}$, then the length of AB is

(1 M)

(a) 3 cm

(b) 4 cm

(c) 6 cm

(d) 7 cm

Sol. (c) $AB + CD = AD + BC$

$$AB + 4 = 3 + 7$$

$$AB = 6\text{ cm}$$

(1 M)

5. If $\sec\theta + \tan\theta = x$, then $\sec\theta - \tan\theta$ will be

(1 M)

(a) x

(b) x^2

(c) $\frac{2}{x}$

(d) $\frac{1}{x}$

Sol. (d) $\frac{1}{\sec\theta + \tan\theta} = \frac{(\sec\theta - \tan\theta)}{(\sec\theta + \tan\theta)(\sec\theta - \tan\theta)} = \frac{(\sec\theta - \tan\theta)}{1} = \sec\theta - \tan\theta$

(1 M)

6. Which one of the following is not a quadratic equation?

(1 M)

(a) $(x + 2)^2 = 2(x + 3)$

(b) $x^2 + 3x = (-1)(1 - 3x)^2$

(c) $x^3 - x^2 + 2x + 1 = (x + 1)^3$

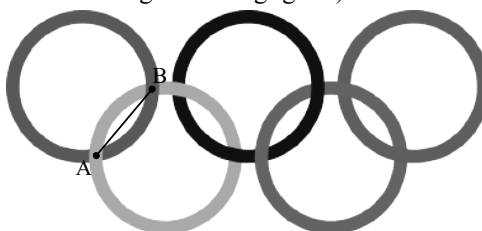
(d) $(x + 2)(x + 1) = x^2 + 2x + 3$

Sol. (d) $(x + 2)(x + 1) = x^2 + 2x + 3$, so, $x^2 + 3x + 2 = x^2 + 2x + 3$ gives $x - 1 = 0$ It's not a quadratic equation.

(1 M)

7. Given below is the picture of the Olympic rings made by taking five congruent circles of radius 1cm each, intersecting in such a way that the chord formed by joining the point of intersection of two circles is also of length 1cm. Total area of all the dotted regions (assuming the thickness of the rings to be negligible) is

(1 M)



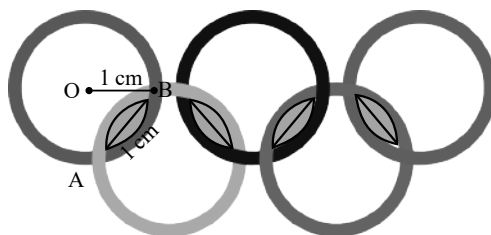
(a) $4\left[\frac{\pi}{12} - \frac{\sqrt{3}}{4}\right]\text{cm}^2$

(b) $\left[\frac{\pi}{6} - \frac{\sqrt{3}}{4}\right]\text{cm}^2$

(c) $4\left[\frac{\pi}{6} - \frac{\sqrt{3}}{4}\right]\text{cm}^2$

(d) $8\left[\frac{\pi}{6} - \frac{\sqrt{3}}{4}\right]\text{cm}^2$

Sol. (d)



Required Area = $8 \times$ area of one segment (with $r = 1\text{ cm}$ and $\theta = 60^\circ$)

$$= 8 \times \left(\frac{60^\circ}{360^\circ} \times \pi \times 1^2 - \frac{\sqrt{3}}{4} \times 1^2 \right)$$

$$= 8 \left[\frac{\pi}{6} - \frac{\sqrt{3}}{4} \right] \text{cm}^2$$

(1 M)

[CLICK HERE](#)

To Discover more

8. A pair of dice is tossed. The probability of not getting the sum eight is

(1 M)

(a) $\frac{5}{36}$

(b) $\frac{31}{36}$

(c) $\frac{5}{18}$

(d) $\frac{5}{9}$

Sol. (b) Probability of getting sum 8 is $\frac{5}{36}$

Probability of not getting sum 8 is $\frac{31}{36}$

(1 M)

9. If $2 \sin 5x = \sqrt{3}$, $0^\circ \leq x \leq 90^\circ$, then x is equal to

(1 M)

(a) 10°

(b) 12°

(c) 20°

(d) 50°

Sol. (b) $\sin 5x = \frac{\sqrt{3}}{2}$

So, $5x = 60^\circ$ and hence $x = 12^\circ$

(1 M)

10. The sum of two numbers is 1215 and their HCF is 81, then the possible pairs of such numbers are

(1 M)

(a) 2

(b) 3

(c) 4

(d) 5

Sol. (c) Since HCF = 81, the numbers can be $81x$ and $81y$

$$81x + 81y = 1215$$

$$x + y = 15$$

which gives four pairs as (1, 14), (2, 13), (4, 11), (7, 8)

(1 M)

11. If the area of the base of a right circular cone is 51 cm^2 and its volume is 85 cm^3 , then the height of the cone is given as

(1 M)

(a) $\frac{5}{6} \text{ cm}$

(b) $\frac{5}{3} \text{ cm}$

(c) $\frac{5}{2} \text{ cm}$

(d) 5 cm

Sol. (d) $\pi r^2 = 51$

$$V = \frac{1}{3} \times \pi r^2 \times h$$

$$85 = \frac{1}{3} \times 51 \times h$$

$$h = \frac{85}{17} = 5 \text{ cm}$$

(1 M)

12. If zeroes of the quadratic polynomial $ax^2 + bx + c$ ($a, c \neq 0$) are equal, then

(1 M)

(a) c and b must have opposite signs

(b) c and a must have opposite signs

(c) c and b must have same signs

(d) c and a must have same signs

Sol. (d) As for equal roots to the corresponding equation, $b^2 = 4ac$

$$\text{Hence } ac = \frac{b^2}{4}$$

And Hence $ac > 0 \Rightarrow c$ and a must have same signs

(1 M)

13. The area (in cm^2) of a sector of a circle of radius 21 cm cut off by an arc of length 22 cm is

(1 M)

(a) 441

(b) 321

(c) 231

(d) 221

Sol. (c) Area of sector

$$= \frac{1}{2} \times l \times r$$

$$= \frac{1}{2} \times 22 \times 21 = 231 \text{ cm}^2$$

(1 M)

14. If $\triangle ABC \sim \triangle DEF$, $AB = 6$ cm, $DE = 9$ cm, $EF = 6$ cm and $FD = 12$ cm, then the perimeter of $\triangle ABC$ is (1 M)
- (a) 28 cm (b) 28.5 cm (c) 18 cm (d) 23 cm

Sol. (c) $\triangle ABC \sim \triangle DEF$

$$\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF} = \frac{\text{Perimeter of } \triangle ABC}{\text{Perimeter of } \triangle DEF}$$

$$\frac{6}{9} = \frac{\text{Perimeter of } \triangle ABC}{27}$$

$$\text{Perimeter of } \triangle ABC = 18 \text{ cm}$$

(1 M)

15. If the probability of the letter chosen at random from the letters of the word "Mathematics" to be a vowel is $\frac{2}{2x+1}$, then x is equal to (1 M)

- (a) $\frac{4}{11}$ (b) $\frac{9}{4}$ (c) $\frac{11}{4}$ (d) $\frac{4}{9}$

Sol. (b) Probability of getting vowels in the word Mathematics is $\frac{4}{11}$,

$$\text{So, } \frac{2}{2x+1} = \frac{4}{11} \Rightarrow x = \frac{9}{4}$$

(1 M)

16. The points A (9, 0), B (9, -6), C (-9, 0) and D (-9, 6) are the vertices of a (1 M)
- (a) square (b) Rectangle (c) Parallelogram (d) Trapezium

Sol. (c) By visualising the figure by plotting points in co-ordinate plane it can be concluded it is a Parallelogram. (1 M)

17. The median of a set of 9 distinct observation is 20.5. If each of the observations of a set is increased by 2, then the median of a new set (1 M)

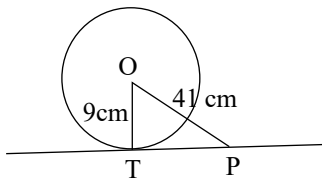
- (a) is increased by 2 (b) is decreased by 2
(c) is two times the original number (d) Remains same as that of original observations

Sol. (a) median is increased by 2 (1 M)

18. The length of a tangent drawn to a circle of radius 9 cm from a point at a distance of 41 cm from the centre of the circle is (1 M)

- (a) 40 cm (b) 9 cm (c) 41 cm (d) 50 cm

Sol. (a)



Since, tangent is perpendicular to the radius at the point of contact

In $\triangle OPT$, right angled at T

$$OP^2 = OT^2 + TP^2$$

$$41^2 = 9^2 + TP^2$$

$$TP^2 = 1681 - 81 = 1600$$

$$TP = 40 \text{ cm}$$

(1 M)

DIRECTIONS: In the question number 19 and 20, a statement of **Assertion (A)** is followed by a statement of **Reason (R)**. Choose the correct option:

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
(b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A)
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

19. Assertion (A): The number 5^n cannot end with the digit 0, where n is a natural number (1 M)

Reason (R): A number ends with 0, if its prime factorization contains both 2 and 5

Sol. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A) (1 M)

20. Assertion (A): If $\cos A + \cos^2 A = 1$, then $\sin^2 A + \sin^4 A = 1$ (1 M)

Reason (R): $\sin^2 A + \cos^2 A = 1$

Sol. (a) $\cos A + \cos^2 A = 1$ (i)

gives $\cos A = \sin^2 A$ (ii) (using $\sin^2 A + \cos^2 A = 1$)

Substituting value of $\cos A$ from (ii) in (i)

$$\sin^2 A + \sin^4 A = 1$$

$\therefore$ Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A) (1 M)

SECTION - B

Section B consists of 5 questions of 2 marks each.

21. (a) The A.P 8, 10, 12 has 60 terms. find the sum last 10 terms (2 M)

OR

(b) Find the middle term of A.P 6, 13, 20,, 230 (2 M)

Sol. (a) $n = 60$, $a = 8$ and $d = 2$

$$t_{60} = 8 + 59(2) = 126 \quad (\frac{1}{2} M)$$

$$t_{51} = 108 \quad (\frac{1}{2} M)$$

$$\text{Hence } t_{51} + t_{52} + \dots + t_{60} = \frac{10}{2} (108 + 126) = 1170 \quad (1 M)$$

OR

(b) $230 = 6 + (n - 1) 7$ gives $n = 33$ (1 M)

$$\therefore \text{Middle Term} = t_{17} = 6 + (16)(7) = 118 \quad (1 M)$$

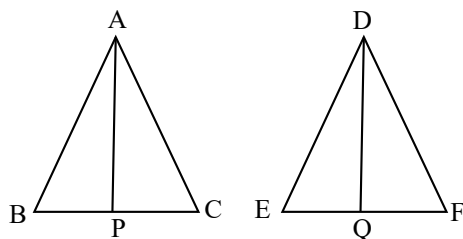
22. If $\sin(A + B) = 1$ and $\cos(A - B) = \frac{\sqrt{3}}{2}$, $0^\circ < A, B, < 90^\circ$, find the measure of angles A and B. (2 M)

Sol. $A + B = 90^\circ$ and $A - B = 30^\circ$ (1 M)

$$A = 60^\circ \text{ and } B = 30^\circ \quad (1 M)$$

23. If AP and DQ are medians of triangles ABC and DEF respectively, where $\triangle ABC \sim \triangle DEF$, then prove that $\frac{AB}{DE} = \frac{AP}{DQ}$ (2 M)

Sol.



$$\triangle ABC \sim \triangle DEF$$

$$\Rightarrow \frac{AB}{DE} = \frac{BC}{EF} \quad (\frac{1}{2} M)$$

$$\frac{AB}{DE} = \frac{2BP}{2EQ} \quad (\text{AP and DQ are the medians}) \quad (\frac{1}{2} M)$$

$$\frac{AB}{DE} = \frac{BP}{EQ}$$

$$\text{In } \triangle ABP \text{ and } \triangle DEQ, \frac{AB}{DE} = \frac{BP}{EQ}$$

$$\angle B = \angle E \quad (\triangle ABC \sim \triangle DEF)$$

$$\Rightarrow \triangle ABP \sim \triangle DEQ \quad (\frac{1}{2} M)$$

$$\text{Hence, } \frac{AB}{DE} = \frac{AP}{DQ} \quad (\frac{1}{2} M)$$

24. (a) A horse, a cow and a goat are tied, each by ropes of length 14m, at the corners A, B and C respectively, of a grassy triangular field ABC with sides of lengths 35m, 40m and 50 m. Find the area of grass field that can be grazed by them.

(2 M)

OR

- (b) Find the area of the major segment (in terms of π) of a circle of radius 5cm, formed by a chord subtending an angle of 90° at the centre.

(2 M)

Sol. (a) area of grass field that can be grazed by them

$$= \frac{\theta_1}{360^\circ} \times \pi r^2 + \frac{\theta_2}{360^\circ} \times \pi r^2 + \frac{\theta_3}{360^\circ} \times \pi r^2$$

$$= \frac{\pi r^2}{360^\circ} (\theta_1 + \theta_2 + \theta_3)$$

$$= \frac{\pi r^2}{360^\circ} \times 180^\circ \quad (1 M)$$

$$= \frac{22}{7} \times \frac{14 \times 14}{2} = 308 \text{ m}^2 \quad (1 M)$$

OR

- (b) Area of minor segment = Area of sector - Area of triangle

$$= \frac{90^\circ}{360^\circ} \pi r^2 - \frac{1}{2} \times r^2$$

$$= \left(\frac{25}{4} \pi - \frac{25}{2} \right) \text{ cm}^2 \quad (1 M)$$

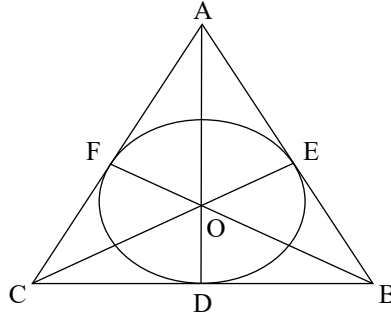
Area of major segment = Area of circle - Area of minor segment

$$= \pi 5^2 - \left(\frac{25}{4} \pi - \frac{25}{2} \right)$$

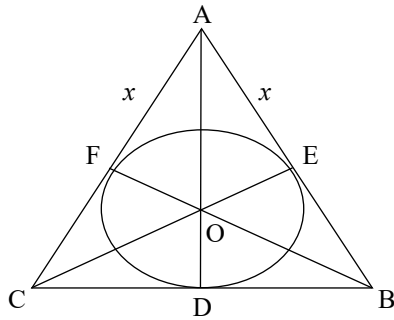
$$= 25\pi - \frac{25}{4} \pi + \frac{25}{2}$$

$$= \left(\frac{75}{4} \pi + \frac{25}{2} \right) \text{ cm}^2 \quad (1 M)$$

25. $\triangle ABC$ is drawn to circumscribe a circle of radius 4 cm such that the segments BD and DC are of lengths 10 cm and 8 cm respectively. Find the lengths of the sides AB and AC, if it is given that $\text{ar}(\triangle ABC) = 90 \text{ cm}^2$ (2 M)



Sol.



Let r be the radius of the inscribed circle

$$BD = BE = 10 \text{ cm}$$

$$CD = CF = 8 \text{ cm}$$

$$\text{Let } AF = AE = x$$

$$\text{ar}(\triangle ABC) = \text{ar}(\triangle AOC) + \text{ar}(\triangle BOC) + \text{ar}(\triangle AOB)$$

$$= \frac{1}{2} \times r \times AC + \frac{1}{2} \times r \times BC + \frac{1}{2} \times r \times AB$$

$$90 = \frac{1}{2} \times 4(x + 8 + 18 + x + 10)$$

$$x = 4.5 \text{ cm}$$

$$\therefore AB = 4.5 + 10 = 14.5 \text{ cm}$$

$$AC = 4.5 + 8 = 12.5 \text{ cm}$$

($\frac{1}{2}$ M)

($\frac{1}{2}$ M)

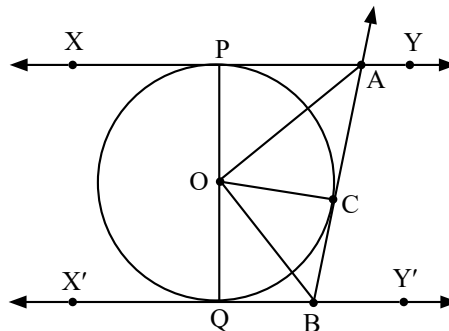
($\frac{1}{2}$ M)

($\frac{1}{2}$ M)

SECTION - C

Section C consists of 6 questions of 3 marks each.

26. In figure, XY and X'Y' are two parallel tangents to a circle with centre O and another tangent AB with point of contact C intersecting XY at A and X'Y' at B. Prove that $\angle AOB = 90^\circ$ (3 M)



Sol. In $\triangle APO$ and $\triangle ACO$

$AP = AC$ (Tangents from External Point)

$AO = AO$ (common)

$OP = OC$ (radii)

$\triangle APO \cong \triangle ACO$

(1 M)

$\angle POQ = 180^\circ$ (PQ is the diameter)

$\angle POA + \angle COA + \angle QOB + \angle COB = 180^\circ$

(1 M)

$2\angle COA + 2\angle COB = 180^\circ$

$\angle AOB = 90^\circ$

(1 M)

27. In a workshop, the number of teachers of English, Hindi and Science are 36, 60 and 84 respectively. Find the minimum number of rooms required, if in each room the same number of teachers are to be seated and all of them being of the same subject. (3 M)

Sol. HCF (36, 60, 84) = 12

(1½ M)

$$\text{Required number of rooms} = \frac{36}{12} + \frac{60}{12} + \frac{84}{12}$$

(1 M)

$$= 3 + 5 + 7 = 15$$

(½ M)

28. Find the zeroes of the quadratic polynomial $2x^2 - (1 + 2\sqrt{2})x + \sqrt{2}$ and verify the relationship between the zeroes and coefficients of the polynomial. (3 M)

Sol. $2x^2 - (1 + 2\sqrt{2})x + \sqrt{2}$

$$= 2x^2 - x - 2\sqrt{2}x + \sqrt{2}$$

(1 M)

$$= (2x - 1)(x - \sqrt{2}) \text{ Hence the zeroes are } \frac{1}{2} \text{ and } \sqrt{2}$$

(1 M)

$$\text{Now } \frac{-b}{a} = \frac{2\sqrt{2} + 1}{2} = \sqrt{2} + \frac{1}{2} = \text{and } \frac{c}{a} = \frac{\sqrt{2}}{2} = \frac{1}{2} \times \sqrt{2}$$

(1 M)

29. (a) If $\sin\theta + \cos\theta = \sqrt{3}$, then prove that $\tan\theta + \cot\theta = 1$

(3 M)

OR

(b) Prove that $\frac{\cos A - \sin A + 1}{\cos A + \sin A - 1} = \operatorname{cosec} A + \cot A$

(3 M)

Sol. (a) $\sin\theta + \cos\theta = \sqrt{3}$ gives $(\sin\theta + \cos\theta)^2 = 3$

(1 M)

$$\text{Hence } 1 + 2 \sin\theta \cos\theta = 3$$

$$\text{So } 2 \sin\theta \cos\theta = 2$$

$$\Rightarrow \sin\theta \cos\theta = 1$$

(1 M)

$$\therefore \tan\theta + \cot\theta = \frac{1}{\sin\theta \cos\theta} = 1$$

(1 M)

OR

$$(b) \frac{\cos A - \sin A + 1}{\cos A - \sin A - 1} = \frac{(\cos A - \sin A + 1)(\cos A + \sin A + 1)}{(\cos A + \sin A - 1)(\cos A + \sin A + 1)}$$

(1 M)

$$= \frac{\cos^2 A + 2 \cos A + 1 - \sin^2 A}{2 \sin A \cos A}$$

(1 M)

$$= \frac{2 \cos A (1 + \cos A)}{2 \sin A \cos A} = \frac{1 + \cos A}{\sin A} = \operatorname{cosec} A + \cot A$$

(1 M)

30. On a particular day, Vidhi and Unnati couldn't decide on who would get to drive the car. They had one coin each and flipped their coin exactly three times. The following was agreed upon: (3 M)

1. If Vidhi gets two heads in a row, she would drive the car
2. If Unnati gets a head immediately followed by a tail, she would drive the car.

Who has greater probability to drive the car that day? Justify your answer.

Sol. $P(\text{Vidhi drives the car}) = \frac{3}{8}$ as favourable outcomes are HHT, THH, HHH (1 M)

$P(\text{Unnati drives the car}) = \frac{4}{8}$ as favourable outcomes are THT, THH, HTH, TTH (1 M)

As $\frac{4}{8} > \frac{3}{8}$

Unnati has greater probability to drive the car (1 M)

31. (a) The monthly income of Aryan and Babban are in the ratio 3:4 and their monthly expenditures are in ratio 5 : 7. If each saves ₹ 15,000 per month, find their monthly incomes. (3 M)

OR

- (b) Solve the following system of equations graphically:

$2x + y = 6$, $2x - y - 2 = 0$. Find the area of the triangle so formed by two lines and x-axis. (3 M)

- Sol.** (a) Let the income of Aryan and Babban be $3x$ and $4x$ respectively and let their expenditure be $5y$ and $7y$ respectively.

(1 M)

Since each saves ₹15,000, we get

$$3x - 5y = 15000$$

$$4x - 7y = 15000$$

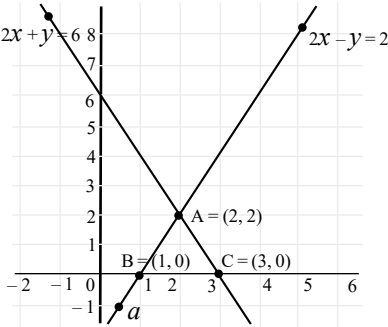
(1 M)

Hence $x = 30000$

Their income thus becomes ₹90,000 and ₹1,20,000 respectively.

(1 M)

OR

- (b)  (2 M)

Hence, the solution is $x = 2$, $y = 2$ ($\frac{1}{2}$ M)

Area = 2 sq. units ($\frac{1}{2}$ M)

SECTION - D

Section D consists of 4 questions of 5 marks each

- 32.** A train travels at a certain average speed for a distance of 63km and then travels at a distance of 72km at an average speed of 6km/hr more than its original speed. If it takes 3 hours to complete the total journey, what is the original average speed? **(5 M)**

Sol. Let the original speed of train be x km/hr

$$\text{Distance} = 63 \text{ km, time } (t_1) = \frac{63}{x} \text{ hrs} \quad (1 \text{ M})$$

$$\text{Faster speed} = (x + 6) \text{ km/hr}$$

$$\text{time } (t_2) = \frac{72}{x+6} \text{ hrs} \quad (1 \text{ M})$$

$$\text{Now } t_1 + t_2 = 3 \text{ hrs}$$

$$\text{So } \frac{63}{x} + \frac{72}{x+6} = 3 \quad (1 \text{ M})$$

$$\Rightarrow 63(x+6) + 72x = 3(x+6)x$$

$$\Rightarrow 135x + 378 = 3x^2 + 18x$$

$$\Rightarrow 3x^2 - 117x - 378 = 0$$

$$\Rightarrow x^2 - 39x - 126 = 0$$

$$\Rightarrow x^2 - 42x + 3x - 126 = 0 \text{ gives } (x+3)(x-42) = 0 \quad (1 \text{ M})$$

$$\text{As } x \text{ can't be negative, so } x = 42 \text{ km/hr} \quad (1 \text{ M})$$

$$\text{The original speed of train} = 42 \text{ km/hr}$$

- 33.** Prove that if a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.

Hence in ΔPQR , prove that a line ℓ intersects the sides PQ and PR of a ΔPQR at L and M respectively such that $LM \parallel QR$. If $PL = 5.7\text{cm}$, $PQ = 15.2\text{cm}$ and $MR = 5.5\text{cm}$, then find the length of PM (in cm) **(5 M)**

Sol. Correct given, figure and construction **(2 M)**

Correct Proof **(2 M)**

Since LM is parallel to QR

$$\text{Let } PM = x$$

$$\frac{PL}{PQ} = \frac{PM}{PR}$$

$$\Rightarrow \frac{5.7}{15.2} = \frac{x}{x+5.5} \quad (\frac{1}{2} \text{ M})$$

$$\Rightarrow x = PM = 3.3 \text{ cm} \quad (\frac{1}{2} \text{ M})$$

- 34. (a)** From a solid right circular cone, whose height is 6cm and radius of base is 12cm, a right circular cylindrical cavity of height 3cm and radius 4cm is hollowed out such that bases of cone and cylinder form concentric circles. Find the surface area of the remaining solid in terms of π . **(5 M)**

OR

- (b)** An empty cone of radius 3 cm and height 12 cm is filled with ice-cream such that the lower part of the cone which is $\left(\frac{1}{6}\right)^{\text{th}}$ of the volume of the cone is unfilled (empty) but a hemisphere is formed on the top. Find the volume of the ice-cream. **(5 M)**

Sol. (a) Slant height of the cone $L = \sqrt{R^2 + H^2} = \sqrt{12^2 + 6^2} = 3\sqrt{20} \text{ cm}$
Curved surface area of cone $= \pi RL = \pi \times 12 \times 3\sqrt{20} = (36\sqrt{20})\pi \text{ cm}^2$ **(1 M)**

Area of base circle of cone (= area of outer circle - area of inner circle + top circular area of cylinder)

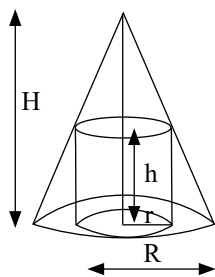


$$= \pi R^2 = \pi \times (12)^2 = 144 \pi \text{ cm}^2$$

(1 M)

$$\text{Curved surface area of cylinder} = 2\pi rh = 2\pi \times 4 \times 3 = 24\pi \text{ cm}^2$$

(1 M)



Surface area of the remaining solid = Curved surface of cone + area of base circle of cone + curved surface area of cylinder (1 M)

$$= (36\sqrt{20})\pi + 144\pi + 24\pi$$

$$= (168 + 36\sqrt{20})\pi \text{ cm}^2$$

(1 M)

OR

$$(b) \text{ Volume of cone} = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi \times 3 \times 3 \times 12 = 36\pi \text{ cm}^3$$

$$\text{Volume of ice-cream in the cone} = \frac{5}{6} \times 36\pi \text{ cm}^3 = 30\pi \text{ cm}^3$$

(2 M)

$$\text{Volume of ice-cream in the hemispherical part} = \frac{2}{3}\pi r^3 = \frac{2}{3}\pi \times 3 \times 3 \times 3 = 18\pi \text{ cm}^3$$

(1½ M)

$$\text{Total volume of the ice-cream} = (30\pi + 18\pi) = 48\pi = 150.86 \text{ cm}^3 \text{ (approx)}$$

(1½ M)

35. (a) If the mode of the following distribution is 55, then find the value of x. Hence, find the mean.

(5 M)

Class Interval	0-15	15-30	30-45	45-60	60-75	75-90
Frequency	10	7	x	15	10	12

OR

(b) A survey regarding heights (in cm) of 51 girls of class X of a school was conducted and the following data was obtained:

Heights (in cm)	Number of girls
less than 140	04
less than 145	11
less than 150	29
less than 155	40
less than 160	46
less than 165	51

Find the median height of girls. If mode of the above distribution is 148.05, find the mean using empirical formula. (5 M)

Sol. (a) Mode of the frequency distribution = 55

Modal class is 45 – 60. Lower limit is 45 class interval (h) = 15

(½ M)

$$\text{Now, Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$$

$$55 = 45 + \frac{15 - x}{30 - x - 10} \times 15$$

(1 M)

So, $x = 5$

(1 M)

CI	f_i	x_i	$f_i x_i$
0-15	10	7.5	75
15-30	7	22.5	157.5
30-45	5	37.5	187.5
45-60	15	52.5	787.5
60-75	10	67.5	675
75-90	12	82.5	990
	59		2872.5

(1½ M)

$$\text{Mean} = \bar{x} = \frac{2872.5}{59} = 48.68$$

(1 M)

OR

(b)

Height (in cm)	Number of girls	Class Interval	Frequency
less than 140	04	135-140	4
less than 145	11	140-145	7
less than 150	29	145-150	18
less than 155	40	150-155	11
less than 160	46	155-160	6
less than 165	51	160-165	5

(1 M)

$$\text{Median} = l + \left(\frac{\frac{N}{2} - Cf}{f} \right) \times h$$

(1 M)

$$= 145 + \left(\frac{\frac{51}{2} - 11}{18} \right) \times 5 = 149.03$$

(1 M)

Median height = 149.03 cm

$$3 \times \text{Median} = \text{Mode} + 2 \times \text{Mean}$$

(1 M)

$$3 \times 149.03 = 148.05 + 2 \times \text{Mean}$$

$$\text{Mean} = 149.52$$

(1 M)

SECTION - E

Section E consists of 3 case study-based questions of 4 marks each.

36. In a class, the teacher asks every student to write an example of A.P. Two boys Aryan and Roshan writes the progression as $-5, -2, 1, 4, \dots$ and $187, 184, 181, \dots$ respectively. Now the teacher asks his various students the following questions on progression

Help the students to find answers for the following:

(i) Find the sum of the common difference of two progressions.

(1 M)

(ii) Find the 34th term of progression written by Roshan.

(1 M)

(iii) (a) Find the sum of first 10 terms of the progression written by Aryan.

(2 M)

OR

(b) Which term of the progressions will have the same value?

(2 M)

Sol. (i) Common difference of first progression = 3
Common difference of second progression = - 3
Sum of common difference = 0

(1 M)

(ii) $t_{34} = 187 + (34 - 1)(-3)$
So, $t_{34} = 88$

(1 M)

(iii) (a) Sum = $\frac{10}{2}[2(-5) + (10-1)(3)]$
= 85

(1 M)

(1 M)

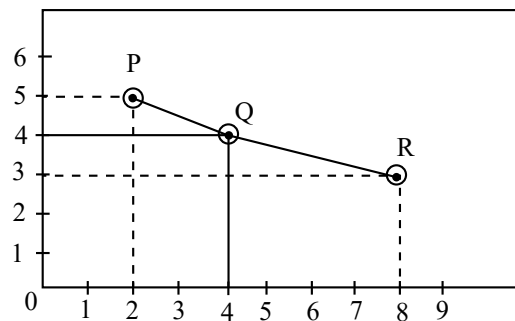
OR

(b) $-5 + (n-1)3 = 187 + (n-1)(-3)$
 $n = 33$

(1 M)

(1 M)

37. (a) A group of class X students goes to picnic during winter holidays. The position of three friends Aman, Kirti and Chahat are shown by the points P, Q and R



- (i) Find the distance between P and R.
(ii) Is Q, the midpoint of PR? Justify the finding midpoint of PR.
(iii) (a) Find the point on x-axis which is equidistant from P and Q.

(1 M)

(1 M)

(2 M)

OR

- (b) Let S be a point which divides the line joining PQ in ratio 2 : 3. Find the coordinates of S.

(2 M)

Sol. (i) $PR = \sqrt{(8-2)^2 + (3-5)^2} = 2\sqrt{10}$

(1 M)

(ii) Co-ordinates of Q (4, 4)

(½ M)

The mid-point of PR is (5, 4)

(½ M)

∴ Q is not the mid-point of PR

(iii) (a) Let the point be (x, 0)

So, $\sqrt{(2-x)^2 + 25} = \sqrt{(4-x)^2 + 16}$

(1 M)

Hence $x = \frac{3}{4}$. Therefore the point is $\left(\frac{3}{4}, 0\right)$

(1 M)

OR

(b) The coordinates of S will be

$\left(\frac{2 \times 4 + 3 \times 2}{2+3}, \frac{2 \times 4 + 3 \times 5}{2+3}\right)$

(1 M)

$= \left(\frac{14}{5}, \frac{23}{5}\right)$

(1 M)

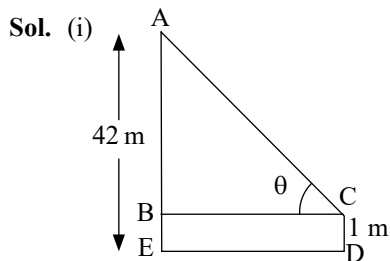
38. India gate (formerly known as All India war memorial) is located near Karthavya path. (formerly Rajpath) at New Delhi. It stands as a memorial to 74187 soldiers of Indian Army, who gave their life in the first world war. This 42m tall structure was designed by Sir Edwin Lutyens in the style of Roman triumphal arches. A student Shreya of height 1 m visited India Gate as a part of her study tour.



- (i) What is the angle of elevation from Shreya's eye to the top of India Gate, if she is standing at a distance of 41m away from the India Gate? (1 M)
- (ii) If Shreya observes the angle of elevation from her eye to the top of India Gate to be 60° , then how far is she standing from the base of the India Gate? (1 M)
- (iii) (a) If the angle of elevation from Shreya's eye changes from 45° to 30° , when she moves some distance back from the original position. Find the distance she moves back. (2 M)

OR

- (b) If Shreya moves to a point which is at a distance of $\frac{41}{\sqrt{3}}$ m from the India Gate, then find the angle of elevation made by her eye to the top of India Gate. (2 M)



Distance from India gate = 41 m,

Height of monument = 42m,

Shreya's height = 1 m

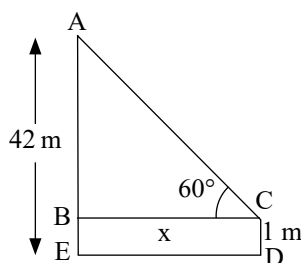
$$\text{So, } \tan \theta = \frac{41}{41} = 1$$

($\frac{1}{2}$ M)

$$\text{Angle of elevation} = \theta = 45^\circ.$$

($\frac{1}{2}$ M)

(ii)



Angle of elevation = 60°

Perpendicular = 41 m

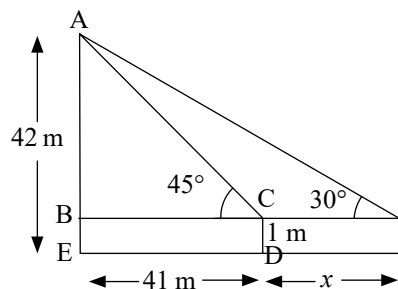
Let the distance from the India Gate be x m

$$\text{Hence } \tan 60^\circ = \frac{41}{x} \quad (\frac{1}{2} M)$$

$$\Rightarrow x = \frac{41}{\sqrt{3}} \quad (\frac{1}{2} M)$$

$\therefore$ Shreya is standing at a distance of $\frac{41\sqrt{3}}{3}$ m

(iii) (a)



Distance from the India Gate = 41 m

let the distance moved back be x m

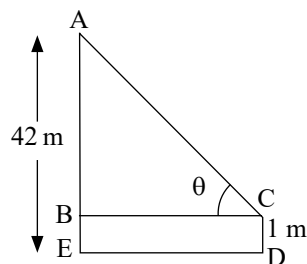
$$\text{then, } \tan 30^\circ = \frac{41}{41+x} \quad (1 M)$$

$$x = (41\sqrt{3} - 41)\text{m} = 41(\sqrt{3} - 1)\text{m} \quad (1 M)$$

$\therefore$ The distance moved back = $41(\sqrt{3} - 1)$ m

OR

(b)



Let the angle of elevation of be θ

$$\text{Now, } \tan \theta = \frac{41}{\frac{41}{\sqrt{3}}} = \sqrt{3} \quad (1 M)$$

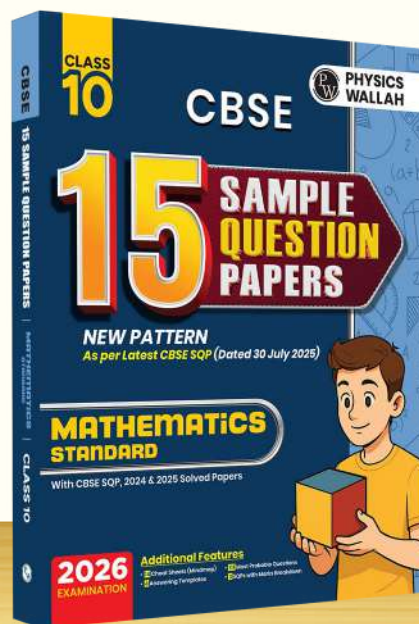
This gives $\theta = 60^\circ$ (1 M)

[CLICK HERE](#)

To Discover more

Class 10 Ki Taiyaari Ho Ab Aur Bhi Aasan!

- 1 Topper's Explanations
- 2 Mistake 101: What not to do!
- 3 Self Assessment Sheet
- 4 Frequently Asked Questions
- 5 CBSE Solved Papers 2024 & 2025
- 6 Answer Writing & OMR Filling Tips
- 7 CBSE Past 5 Years' Paper Trend Analysis
- 8 Cheat Sheets (Mind Maps)
- 9 111 Most Probable Questions
- 10 Level-wise (Easy, Medium, Hard) Sample Papers
- 11 CBSE Board Exam 2026: Two-Exam Scheme Decoded
- 12 8 Sample Papers with detailed explanations (Step-wise Marking)
- 13 4 Sample Papers with handwritten explanations through QR code
- 14 Question Typology, Evolving Trends in CBSE Exam Patterns, Preparation Guide
- 15 CBSE Sample Question Paper 2025-26 (with CBSE Marking Scheme)



AVAILABLE ON GIVEN LINKS



Amazon Link

PW Store Link



Roll No.

--	--	--	--	--	--	--	--

Q.P. Code **01**



Candidates must write the Q.P. Code on the title page of the answer book.

SAMPLE QUESTION PAPER-I

MATHEMATICS (STANDARD) - Theory

Time allowed : 3 hours

Maximum Marks : 80

NOTE:

- (i) Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
- (ii) Please check that this question paper contains **38** questions.
- (iii) **Please write down the Serial Number of the question in the answer-book before attempting it.**
- (iv) 15 minute time has been allotted to read this question paper. The students will read the question paper only and will not write any answer on the answer-book during this period.

GENERAL INSTRUCTIONS:

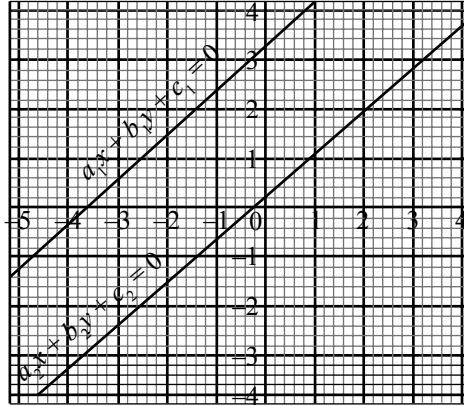
Read the following instructions carefully and follow them:

- (i) This question paper contains **38** questions. **All** questions are compulsory.
- (ii) Question paper is divided into **FIVE** sections – **Section A, B, C, D** and **E**.
- (iii) In **Section A** – question number **1** to **18** are multiple choice questions (MCQs) and question number **19** and **20** are Assertion-Reason based questions of **1** mark each.
- (iv) In **Section B** – question number **21** to **25** are Very Short Answer (VSA) type questions of **2** Marks each.
- (v) In **Section C** – question number **26** to **31** are Short Answer (SA) type questions carrying **3** marks each.
- (vi) In **Section D** – question number **32** to **35** are Long Answer (LA) type questions carrying **5** marks each.
- (vii) In **Section E** – question number **36** to **38** are **case based integrated units** of assessment questions carrying **4** marks each. Internal choice is provided in **2** marks question in each case-study.
- (viii) There is no overall choice. However, an internal choice has been provided in **2** questions in **Section B**, **2** questions in **Section C**, **2** questions in **Section D** and **3** questions in **Section E**.
- (ix) Draw neat figures wherever required. Take $\pi = 22/7$ wherever required if not stated.
- (x) Use of calculators is **NOT** allowed.

SECTION - A

Section - A consists of Multiple Choice type questions of 1 mark each.

- If the zeroes of the quadratic polynomial $ax^2 + bx + c$, ($c \neq 0$) are equal, then
 (a) c and b have opposite sign. (b) c and a have opposite sign.
 (c) c and b have same sign. (d) c and a have same sign.
- The lines representing the given pair of linear equations are non-intersecting. Which of the following statements is true?



- $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ (b) $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$
 (c) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2} = \frac{c_1}{c_2}$ (d) $\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$
- 30th term of the A.P. : 10, 7, 4, ... is
 (a) 97 (b) 77 (c) -77 (d) -87
- The distance between the points $(m, -n)$ and $(-m, n)$ is
 (a) $\sqrt{m^2 + n^2}$ (b) $m + n$ (c) $2\sqrt{m^2 + n^2}$ (d) $\sqrt{2m^2 + 2n^2}$
- The length of the tangent from an external point A on a circle with centre O is
 (a) Always greater than OA . (b) Equal to OA . (c) Always less than OA . (d) Cannot be estimated.
- If $\sin A + \sin^2 A = 1$, then the value of the expression $\cos^2 A + \cos^4 A$ is
 (a) 1 (b) $\frac{1}{2}$ (c) 2 (d) 3
- A rectangular garden has a perimeter of 60 meters. The area of the garden can be expressed as a quadratic function $A(x) = x^2 - 15x$, where x is the width of the garden in meters.

Which of the following equations must Ravi be considering if one of its roots is zero?

Statement I: The roots of the quadratic equation $A(x) = 0$ represent the possible dimensions of the garden.

Statement II: The discriminant of $A(x) = 0$ is positive, indicating two distinct real roots.

Statement III: The sum of the roots of $A(x) = 0$ equals the perimeter of the garden.

Which of the following statements is/are correct?

- Only statement I (b) Only statement I and II
 (c) Only statement II and III (d) All statement I, II and III

8. The value of $\sqrt{6 + \sqrt{6 + \sqrt{6 + \dots \infty}}}$ is:

- (a) 4 (b) 3 (c) 3.5 (d) -3

9. Which term of the sequence 4, 9, 14, 19,.... is 124?

- (a) 15 (b) 20 (c) 25 (d) 30

10. Shreya collects the following data on the number of movies watched by her friends in the month of June.

Names	Shailja	Nikita	Arima	Meena	Dune
No. of Movies watched	3	8	9	4	1

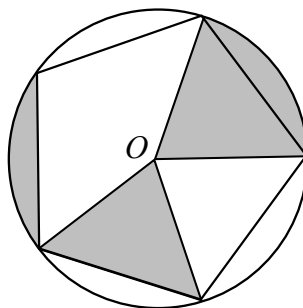
What is the average number of movies watched by Shreya's friends in that particular month?

- (a) 4.16 (b) 4.20 (c) 5 (d) 9

11. The value(s) of k for which the quadratic equation $2x^2 + kx + 2 = 0$ has equal roots, is

- (a) 4 (b) ± 4 (c) -4 (d) 0

12. A regular pentagon is inscribed in a circle with centre O of radius 5 cm, as shown below:



What is the area of the shaded part of the circle?

- (a) $2\pi \text{ cm}^2$ (b) $4\pi \text{ cm}^2$ (c) $5\pi \text{ cm}^2$ (d) $10\pi \text{ cm}^2$

13. The numbers of multiples of 4 between 10 and 250 is

- (a) 50 (b) 40 (c) 60 (d) 30

14. The probability that a non-leap year selected at random will contain 53 Sundays is:

- (a) $\frac{1}{7}$ (b) $\frac{2}{7}$ (c) $\frac{3}{7}$ (d) $\frac{5}{7}$

15. The pair of equations $x + 2y + 5 = 0$ and $-3x - 6y + 1 = 0$ have

- (a) A unique solution (b) Exactly two solution
(c) Infinitely many solution (d) No solution

16. There are two cylinders of radius ' R ' and ' r ' and having the same height. Find the ratio of their lateral surface areas.

- (a) 2 : 3 (b) $H : h$
(c) $R : r$ (d) None of these

17. If a pole 6 m high casts a shadow $2\sqrt{3}$ m long on the ground, then sun's elevation is

- (a) 60° (b) 45° (c) 30° (d) 90°

18. If α, β are the zeros of the quadratic polynomial $p(x) = x^2 - (k + 6)x + 2(2k - 1)$, then the value of k , if $\alpha + \beta = \frac{1}{2}\alpha\beta$, is

- (a) -7 (b) 7 (c) -3 (d) 3

DIRECTIONS: In the question number **19** and **20**, a statement of **Assertion (A)** is followed by a statement of **Reason (R)**. Choose the correct option out of the following:

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of (A).
- (b) Both Assertion (A) and Reason (R) are true but Reason (R) is not the correct explanation of Assertion (A).
- (c) Assertion (A) is true but Reason (R) is false.
- (d) Assertion (A) is false but Reason (R) is true.

19. Assertion (A): The HCF of two numbers is 18 and their product is 3072. Then their LCM = 169

Reason (R): If a, b are two positive integers, then $\text{HCF} \times \text{LCM} = a \times b$.

20. Assertion (A): If $\cos A + \cos^2 A = 1$ then $\sin^2 A + \sin^4 A = 2$.

Reason (R): $1 - \sin^2 A = \cos^2 A$, for any value of A .

SECTION - B

Section - B consists of Very Short Answer (VSA) type questions of 2 marks each.

- 21. (a)** Zain is designing a lock with three concentric rings, each marked with numbers from 1 to 60. The lock opens when the numbers on the rings form a geometric sequence and their HCF is a prime number. If the middle number is 12, what is the sum of all three numbers in the sequence?

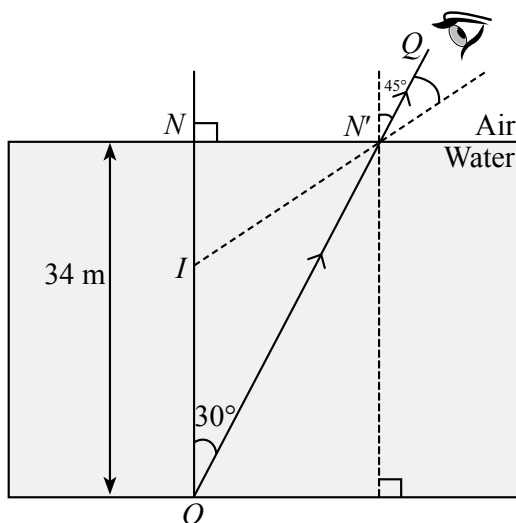
OR

(b) Given that $\text{HCF}(306, 657) = 9$. Find $\text{LCM}(306, 657)$.

- 22.** A city planning team needs to place a water fountain exactly halfway between two playgrounds located at coordinates $(2, -3)$ and $(x, 5)$. The midpoint must also lie on the line $3x + 2y = 7$.

Determine the value of x .

- 23.** Shown below is a rectangular tub of water of depth 34 cm. An object O is at the bottom of the tub. The image of the object is formed at I for an observer at Q .

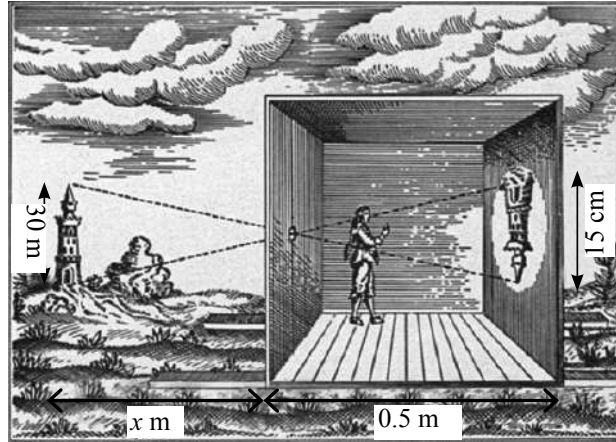


Find the distance by which the object seems to be moved for the observer. Show your work and give valid reasons.

(Note: Take $\sqrt{2} = 1.4$, $\sqrt{3} = 1.7$)

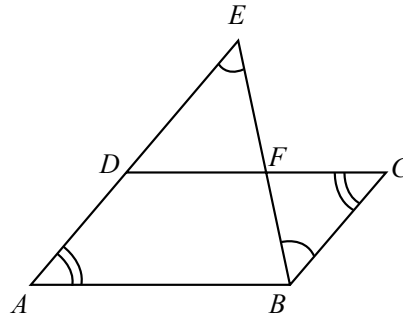
- 24.** A cottage industry produces a certain number of pottery articles in a day. It was observed on a particular day that the cost of production of each article (in rupees) was 3 more than twice the number of articles produced on that day. If the total cost of production on that day was ₹ 90, find the number of articles produced and the cost of each article.

25. (a) A photographer is using a camera obscura to project an image of a 30 m tall building onto a screen. If the pinhole of the camera is 0.5 m from the screen and the projected image is 15 cm tall, how far is the camera from the building?



OR

- (b) E is a point on the side AD produced of a parallelogram $ABCD$ and BE intersects CD at F . Show that $\triangle ABE \sim \triangle CFB$.



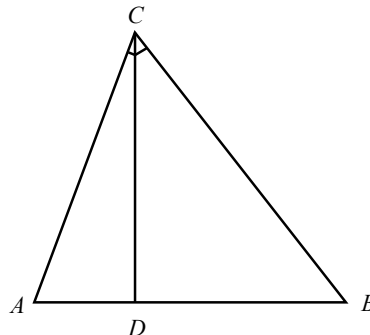
SECTION - C

Section - C consists of Short Answer (SA) type questions of 3 marks each.

26. A river runs along the line $y = 3x + 2$. A bridge needs to be constructed perpendicular to the river such that one end of the bridge is at point $P(4, 14)$.

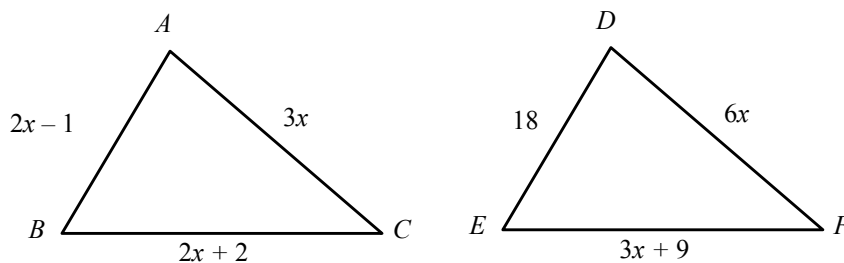
Determine the coordinates of the point where the bridge ends at $R(x, y)$ if it intersects the river at $Q(1, y)$ and divides the bridge in $2 : 3$ at Q .

27. Show that $5 + 2\sqrt{7}$ is an irrational number, where $\sqrt{7}$ is given to be an irrational number.
28. (a) In Fig., $\angle ACB = 90^\circ$ and $CD \perp AB$, prove that $CD^2 = BD \times AD$.



OR

- (b) In Fig. if $\triangle ABC \sim \triangle DEF$ and their sides of lengths (in cm) are marked along them, then find the lengths of sides of each triangle.

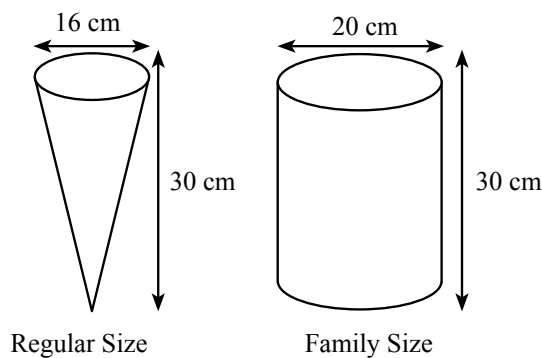


29. (a) If one zero of the polynomial $p(x) = (a^2 + 9)x^2 + 45x + 6a$ is reciprocal of the other, find the value of a .

OR

- (b) If one zero of the polynomial $3x^2 - 8x + 2k + 1$ is seven times other, find the value of k .

30. If $\operatorname{cosec} \theta - \sin \theta = a^3$ and $\sec \theta - \cos \theta = b^3$, prove that: $a^2 b^2 (a^2 + b^2) = 1$
31. A theatre offers 2 popcorn sizes - regular and family size as shown in the figure below.

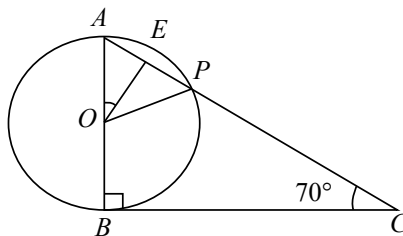


Yamir and his friends have the choice of buying either 5 regular portions or 1 family, size portion, both priced the same. Which option should they choose to get the most popcorn? Show your work.

SECTION - D

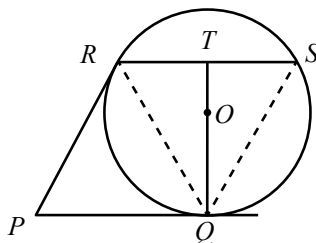
Section - D consists of Long Answer (LA) type questions of 5 Marks each.

32. (a) In given figure, BC is a tangent to a circle with centre O and OE bisects chord AP . If $\angle ACB = 70^\circ$, show that $\angle AOE = 70^\circ$.

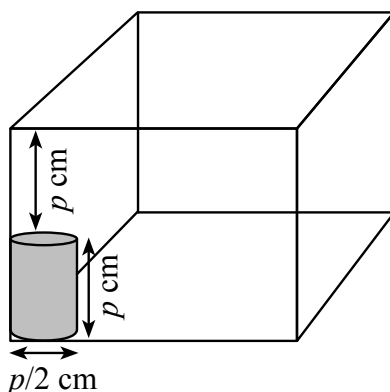


OR

- (b) Tangents PQ and PR are drawn to a circle such that $\angle RPQ = 30^\circ$. A chord RS is drawn parallel to the tangent PQ . Find $\angle RQS$.



33. Shown below is a cylindrical can placed in a cubical container.



- (i) How many of these cans can be packed in the container such that no more cans are fitted?
(ii) If the capacity of one can is 539 ml, find the internal volume of the cubical container.

Show your work.

(Note: Take π as $\frac{22}{7}$)

34. (a) A thief and a policeman are running along the same path. The thief starts running with a constant speed of 100 meters per minute. After a one-minute, the policeman begins his chase. In the first minute of his run, the policeman matches the thief's speed at 100 meters per minute. However, every subsequent minute, the policeman increases his speed by 10 meters per minute. How long will it take for the policeman to catch up to the thief?

OR

- (b) If the ratio of the sum of first n terms of two A.P.s is $(7n + 1) : (4n + 27)$, find the ratio of their m^{th} terms.

35. Find the mean, median and mode of the following data:

Classes	0-20	20-40	40-60	60-80	80-100	100-120	120-140
Frequency	6	8	10	12	6	5	3

SECTION - E

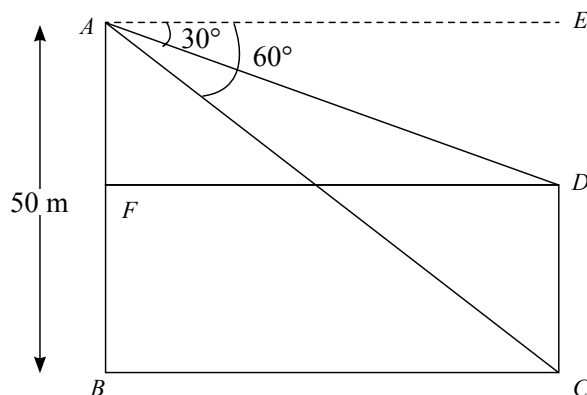
Section - E consists of three Case Study Based questions of 4 marks each.

36. In Bangalore, there are two buildings on either side of a busy road connected by an overbridge. One building is 50 meters high. A man, standing on the top of the 50 -meter high building, observed from the top that the angles of depression to the top and foot of the other building across the road are 30 degrees and 60 degrees, respectively.

(Take $\sqrt{3} = 1.73$)

[CLICK HERE](#)

To Discover more



Based on the given information, answer the following questions:

- (i) What is the measure of $\angle ADF$?
- (ii) What is the measure of $\angle ACB$?
- (iii) Calculate the width of the road between the two buildings.

1
1
2

OR

Determine the height of the other building.

37. Sahiba conducted a survey in her school for 150 students of Class 10. She asked the students two multiple choice questions, which were “What time do you go to sleep at night?” and “What is your favourite subject?”. Each student could choose only one option from the choices given.

Sahiba tabulated the results from her survey as shown below.



Sleep Schedule	Favourite Subject			
Time	English	Mathematics	Science	Social Science
Before 9 PM	5	7	8	7
9 PM-10 PM	10	12	11	9
10 PM-11 PM	10	12	13	13
After 11 PM	7	8	10	8

Based on the given information, answer the following questions:

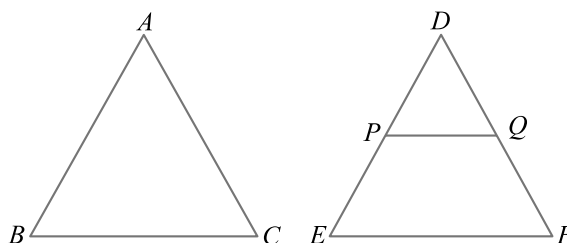
- (i) If a student is randomly selected, what is the probability that they sleep after 11 PM and that their favourite subject is NOT Social Science? **1**
- (ii) If a student is randomly selected, what is the probability that they go to sleep after 10 PM? **1**
- (iii) If a student is randomly selected, what is the probability that they go to sleep between 9 PM and 10 PM and that their favourite subject is Mathematics? **2**

OR

If a student is randomly selected, what is the probability that they go to sleep before 10 PM and that their favourite subject is either Science or Social Science?

38. Triangle is a very popular shape used in interior designing. The picture given above shows a cabinet designed by a famous interior designer.

Here the largest triangle is represented by $\triangle ABC$ and smallest one with shelf is represented by $\triangle DEF$. PQ is parallel to EF .



Based on the given information, answer the following questions:

- (i) Show that $\triangle DPQ \sim \triangle DEF$. **1**
- (ii) If $DP = 50$ cm and $PE = 70$ cm then find $\frac{PQ}{EF}$. **1**
- (iii) If $2AB = 5DE$ and $\triangle ABC \sim \triangle DEF$ then show that $\frac{\text{perimeter of } \triangle ABC}{\text{perimeter of } \triangle DEF}$ is constant. **2**

OR

If AM and DN are medians of triangles ABC and DEF respectively then prove that $\triangle ABM \sim \triangle DEN$.

SAMPLE QUESTION PAPER-I

(Explanations)

Marking Scheme (Ques 1-20)



30 Min

Each question carries 1 mark.

- (d) We know, for equal roots, discriminant will be equal to zero.
 $\therefore D = 0$
 $\Rightarrow b^2 - 4ac = 0 \Rightarrow b^2 = 4ac$
 $\Rightarrow ac = b^2/4 \Rightarrow ac > 0$
 Hence, it is only possible when both a and c have same sign.
- (b) The lines representing the linear equations are parallel. Hence, we have no solution for the given pair of equations.
 and $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ is true in case of no solution.
- (c) Given: $a = 10, n = 30$
 $d = 7 - 10 = -3$
 We know $a_n = a + (n - 1)d$
 $\therefore a_{30} = 10 + (30 - 1)(-3)$
 $= 10 - 29 \times 3 = -77$
- (c) Given points are $(m, -n)$ and $(-m, n)$
 Let, $x_1 = m, y_1 = -n$
 $x_2 = -m, y_2 = n$
 Distance between A and B
 $AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
 $\Rightarrow AB = \sqrt{(-m - m)^2 + (n - (-n))^2}$
 $\Rightarrow AB = \sqrt{(-2m)^2 + (2n)^2} \Rightarrow AB = 2\sqrt{m^2 + n^2}$

Topper's Explanation

(CBSE 2020)

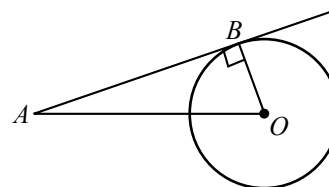
$$\begin{aligned} &A(m, -n) \\ &B(-m, n) \\ &AB = \sqrt{(m - (-m))^2 + (-n - n)^2} \\ &AB = \sqrt{4m^2 + 4n^2} \\ &AB = 2\sqrt{m^2 + n^2} \end{aligned}$$



Mistakes 101 : What not to do!

In this type of problem, students may do mistakes in entering incorrect coordinates into the formula.

- (c) We know, The tangent is perpendicular to the radius of the circle, then angle between them is 90° .



Thus OA is hypotenuse for the right triangle OAB , which is right-angled at B .

For any right triangle, the hypotenuse is the longest side. The length of the tangent from an external point is always less than the OA .

- (a) Given, $\sin A + \sin^2 A = 1$
 $\sin A = 1 - \sin^2 A = \cos^2 A$ [$\because \sin^2 \theta + \cos^2 \theta = 1$]
 On squaring both sides, we get
 $\sin^2 A = \cos^4 A$
 $\Rightarrow 1 - \cos^2 A = \cos^4 A$
 $\Rightarrow \cos^2 A + \cos^4 A = 1$
- (b) **Statement I:** $A(x) = x^2 - 15x = x(x - 15) = 0$
 Roots are $x = 0$ and $x = 15$.
 These represent the width and length of the garden. Statement I is correct.
Statement II:
 Discriminant $= b^2 - 4ac = (-15)^2 - 4(1)(0) = 225 > 0$.
 This indicates two distinct real roots. Statement II is correct.
Statement III:
 Sum of roots $= -b/a = 15$, Perimeter $= 60$ meters,
 Sum of roots $\neq$ Perimeter. ($\because 15 \neq 60$)
 Statement III is incorrect.
 Therefore, only statements I and II are correct.
- (b) Let, $\sqrt{6 + \sqrt{6 + \sqrt{6 + \dots}}} = x$
 $\therefore \sqrt{6 + x} = x$
 On squaring both sides, we get

$$6 + x = x^2 \Rightarrow x^2 - x - 6 = 0$$

$$\Rightarrow (x - 3)(x + 2) = 0 \Rightarrow x = -2, 3$$

Since, x cannot be negative therefore $x = 3$.

9. (c) The given sequence is an A.P. with first term (a) = 4 and common difference (d) = 5.

Let n^{th} term of an A.P. be = 124

$$\therefore a_n = 124 \Rightarrow a + (n - 1)d = 124$$

$$\Rightarrow 4 + (n - 1) \times 5 = 124 \Rightarrow n = 25$$

Therefore, 124 is the 25th term of the given sequence.

10. (c)

Names	No. of Movies Watched
Shailja	3
Nikita	8
Arima	9
Meena	4
Dune	1
Total	25

$$\text{Average} = \frac{\text{Total number of movies watched}}{\text{Number of friends}}$$

$$\Rightarrow \text{Average} = \frac{25}{5} = 5$$

The average number of movies watched by Shreya's friends in the month of June is 5.

11. (b) Given that quadratic equation $2x^2 + kx + 2 = 0$ has equal roots.

By comparing with the quadratic equation $x^2 + bx + c = 0$, we get $a = 2$, $b = k$ and $c = 2$.

We know that the quadratic equation $ax^2 + bx + c = 0$ has equal roots, if $b^2 - 4ac = 0$.

$$\text{Therefore, } k^2 - 4 \times 2 \times 2 = 0$$

$$\Rightarrow k^2 = 4^2 = 16 \Rightarrow k = \pm 4.$$

Topper's Explanation

(CBSE 2020)

$$\begin{aligned} 2x^2 + kx + 2 &= 0 \\ \text{For equal roots;} \\ b^2 - 4ac &= 0 \\ k^2 - 16 &= 0 \\ k^2 &= 16 \\ k &= \pm 4 \\ \text{Ans (B) } \pm 4 \end{aligned}$$

Mistakes 101 : What not to do!

In questions involving quadratic equations, students often make mistakes when looking at the coefficients of x^2 and x .

12. (d) Angle of the regular polygon $= \frac{360^\circ}{5} = 72^\circ$

Therefore, Area of the shaded part

$$= 2 \times \frac{\theta}{360^\circ} \times \pi r^2 = 2 \times \frac{72^\circ}{360^\circ} \times \pi \times (5)^2 = 10\pi \text{ cm}^2$$

13. (c) Multiple of 4 between 10 and 250 are

12, 16, 20, 24, ... 248

$$a = 12, d = 4, a_n = 248$$

$$\text{we know, } a_n = a + (n - 1)d$$

$$\Rightarrow 248 = 12 + (n - 1)4 \Rightarrow 236 = (n - 1)4$$

$$\Rightarrow n = 60$$

14. (a) No. of days in a non-leap year = 365 days

$$365 \text{ days} = 52 \text{ weeks} + 1 \text{ day}$$

For 52 weeks, no. of Sunday = 52

1 remaining day can be Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday.

Total number of possible outcomes = 7, number of favourable outcomes = 1

$$\begin{aligned} \text{Probability} &= \frac{\text{Number of favourable outcomes}}{\text{Total number of possible outcomes}} \\ &= \frac{1}{7} \end{aligned}$$

15. (d) Given: pair of equation $x + 2y + 5 = 0$ and $-3x - 6y + 1 = 0$

Comparing pair of equation with $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, we get

$$\text{Now, } a_1 = 1, a_2 = -3, b_1 = 2, b_2 = -6, c_1 = 5, c_2 = 1$$

$$\frac{a_1}{a_2} = \frac{1}{-3}, \frac{b_1}{b_2} = \frac{2}{-6}, \frac{c_1}{c_2} = \frac{5}{1} \Rightarrow \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

Hence, no solution.

16. (c) Given, h is the height of both cylinders.

Let R be the radius of 1st cylinder and r be the radius of 2nd cylinder.

$$\frac{(\text{C.S.A})_1}{(\text{C.S.A})_2} = \frac{2\pi Rh}{2\pi rh} = \frac{R}{r} = R : r$$

17. (a) Given that;

Height of the pole (AB)

$$= 6 \text{ m}$$

Length of shadow (BC)

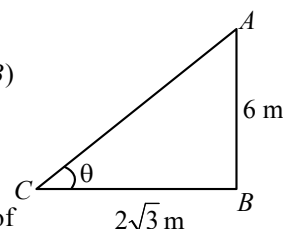
$$= 2\sqrt{3} \text{ m}$$

Let θ be the elevation of the sun

Now, in $\triangle ABC$

$$\tan \theta = \frac{AB}{BC} \Rightarrow \tan \theta = \frac{6}{2\sqrt{3}} = \sqrt{3} = \tan 60^\circ$$

$$\therefore \theta = 60^\circ$$



18. (b) Given, $p(x) = x^2 - (k+6)x + 2(2k-1)$.

Let α and β are zeroes of $p(x)$.

$$\therefore \alpha + \beta = k + 6$$

[sum of roots of quadratic polynomial]

$$\alpha\beta = 2(2k-1)$$

[product of roots of quadratic polynomial]

Also given,

$$\alpha + \beta = \frac{1}{2}\alpha\beta \Rightarrow (k+6) = \frac{1}{2} \cdot 2(2k-1)$$

$$\Rightarrow k+6 = 2k-1 \Rightarrow 2k-k = 6+1 \Rightarrow k=7$$

19. (d) Here reason is true (Standard result). Assertion is false.

We know that, for any two numbers, product of the two numbers

$$= \text{HCF} \times \text{LCM} = 18 \times 169$$

$$= 3042 \neq 3072$$

20. (d) Given Assertion

$$\cos A + \cos^2 A = 1$$

$$\cos A = 1 - \cos^2 A = \sin^2 A$$

$$\text{and } \sin^2 A + \sin^4 A$$

$$= \cos A + \cos^2 A = 1$$

$$\therefore \sin^2 A + \sin^4 A = 1$$

$$\text{and reason } 1 - \sin^2 A$$

$$= \cos^2 A \text{ is true}$$

Assertion (A) is false but reason (R) is true.

21. (a)

Marking Scheme



2.5 Min

- ☞ List all possible geometric sequences based on the given conditions (½ M)
- ☞ Determine the HCF of each sequence and check if it is a prime number. (½ M)
- ☞ Select the valid sequence where the HCF is a prime number. (½ M)
- ☞ Sum the numbers in the valid sequence to get the final answer. (½ M)

For a geometric sequence with middle term 12, possible sequences are: 3, 12, 48 or 4, 12, 36 or 6, 12, 24

HCF for each sequence: HCF (3, 12, 48) = 3 (prime)

HCF (44, 12, 36) = 4 (not prime)

HCF (6, 12, 24) = 6 (not prime)

The only sequence satisfying both conditions is 3, 12, 48

Sum of the numbers: $3 + 12 + 48 = 63$

The sum of the three numbers is 63.

OR

- (b)

Marking Scheme



2.5 Min

- ☞ Identify the given values for HCF. (½ M)
- ☞ Apply the formula that relates HCF, LCM, and the product of numbers. (½ M)
- ☞ Rearrange the formula to solve for the LCM. (½ M)
- ☞ Calculate the LCM based on the rearranged equation. (½ M)

Given that $\text{HCF} (306, 657) = 9$, As we know that,
 $\text{HCF} \times \text{LCM} = \text{Product of numbers}$

$$\therefore 9 \times \text{LCM} = 306 \times 657 \Rightarrow \text{LCM} = \frac{306 \times 657}{9}$$

$$= 22338$$

- 22.

Marking Scheme



2.5 Min

- ☞ Apply the midpoint formula to find the midpoint of the given points. (½ M)
- ☞ Identify the equation of the line provide in the problem. (½ M)
- ☞ Substitute the midpoint into the line equation to check for consistency or solve for unknowns. (½ M)
- ☞ Solve the equation to determine the unknown value. (½ M)

Tip: Midpoint = $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$

By Midpoint Formula, we have

$$M = \left(\frac{2+x}{2}, \frac{-3+5}{2} \right) = \left(\frac{2+x}{2}, 1 \right)$$

Since the point lies in the given line $3x + 2y = 7$.

Hence it must be satisfied, substitute the value in the given equation of line.

$$\therefore 3 \left(\frac{2+x}{2} \right) + 2(1) = 7 \Rightarrow 3x = 4 \Rightarrow x = \frac{4}{3}$$

- 23.

Marking Scheme



3 Min

- ☞ Apply trigonometry to solve using the tangent ratio. (½ M)
- ☞ Use angle properties (corresponding angles with parallel lines) to proceed. (½ M)
- ☞ Apply trigonometric ratios in the triangle based on the given angles. (½ M)
- ☞ Calculate the unknown distance based on geometric relations and trigonometric application. (½ M)

Tip: $\tan \theta = \frac{\text{Opposite Side}}{\text{Adjacent Side}}$

We have to find OI ,

In $\triangle NON'$

$$\tan 30^\circ = \frac{NN'}{ON} \Rightarrow \frac{1}{\sqrt{3}} = \frac{NN'}{34} \Rightarrow NN' = \frac{34}{\sqrt{3}} \text{ cm.}$$

$\angle NIN' = 45^\circ$ (Corresponding angles when ON and PN' are parallel and IN' is the transversal.)

$$\text{Now in } \triangle NIN', \tan 45^\circ = \frac{NN'}{NI} \Rightarrow NI = \frac{34}{\sqrt{3}} \text{ cm.}$$

$$\therefore OI = ON - NI$$

$$= 34 - \frac{34}{\sqrt{3}} = \frac{34(\sqrt{3}-1)}{\sqrt{3}} = \frac{34(1.7-1)}{1.7}$$

$$= \frac{34 \times 0.7}{1.7} = 14 \text{ cm.}$$

24.

Marking Scheme

3 Min

- ☞ Let the number of articles be x . Form the equation based on the given conditions. ($\frac{1}{2}$ M)
- ☞ Expand and rearrange the quadratic equation, splitting the middle term to simplify. ($\frac{1}{2}$ M)
- ☞ Factorize the quadratic equation and solve for x , rejecting any negative solutions. ($\frac{1}{2}$ M)
- ☞ Find the number of articles and calculate the cost of each article based on the solution. ($\frac{1}{2}$ M)

Let the number of articles produced in a day be x .

$\therefore$ Cost of production of each article = ₹ $(2x + 3)$...(i)

Given, total cost of production is ₹ 90

No. of articles $\times$ Cost of production of each article = Total Cost

$$\therefore x(2x + 3) = 90 \Rightarrow 2x^2 + 3x - 90 = 0$$

$$\Rightarrow 2x^2 + 15x - 12x - 90 = 0$$

$$\Rightarrow x(2x + 15) - 6(2x + 15) = 0$$

$$\Rightarrow (2x + 15)(x - 6) = 0 \Rightarrow x = \frac{-15}{2} \text{ or } x = 6$$

As the number of articles produced can not be negative. Therefore, x can only be 6.

Hence, number of articles produced = 6

From equation (i), Cost of each article = $(2 \times 6) + 3$ = ₹ 15

Mistakes 101 : What not to do!

Students often make mistakes by not properly aligning equations with the problem's conditions. Ensure all terms are correctly multiplied and both valid solutions are evaluated, accounting for constraints like non-negative values.

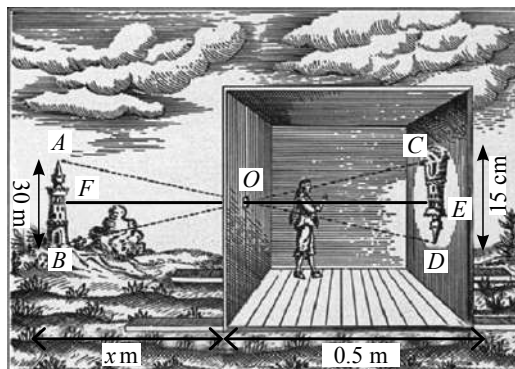
25. (a)

Marking Scheme

4 Min

- ☞ Identify similar triangles based on the given scenario. ($\frac{1}{2}$ M)
- ☞ Let x be the distance of the camera from the building. Convert the units for the given distance. ($\frac{1}{2}$ M)
- ☞ Use the ratio of corresponding sides in similar triangles to set up an equation. ($\frac{1}{2}$ M)
- ☞ Solve for x , the distance of the camera from the building, and find the solution. ($\frac{1}{2}$ M)

In obscura camera, the triangle formed by the building and camera pinhole is similar to the triangle formed by the image and pinhole.



$$\therefore \triangle AOB \sim \triangle DOC.$$

Let x be the distance of camera from the building.

Here $CD = 15 \text{ cm} = 0.15 \text{ m}$

As we know that in similar triangle the ratio of corresponding sides is also equal to the corresponding altitudes.

$$\therefore \frac{AB}{CD} = \frac{OF}{OE} \Rightarrow \frac{30}{0.15} = \frac{x}{0.5} \Rightarrow x = 100 \text{ m}$$

Hence, the camera is 100 m from the building.

OR

(b)

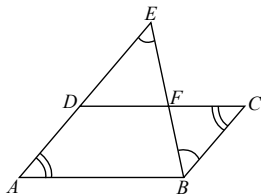
Marking Scheme

4 Min

- ☞ Given: Identify the relevant points and lines on the geometric figure and the triangles to be proved similar. ($\frac{1}{2}$ M)
- ☞ Establish that certain angles are equal based on properties of the figure (e.g., opposite angles of a parallelogram). ($\frac{1}{2}$ M)
- ☞ Show that additional angles are equal using alternate interior angles or other angle properties. ($\frac{1}{2}$ M)
- ☞ Apply the AA similarity criterion to prove the triangles are similar. ($\frac{1}{2}$ M)

Given: E is a point on the side AD produced of a parallelogram $ABCD$ and BE intersects CD at F .

To prove: $\triangle ABE \sim \triangle CFB$



Proof: In $\triangle ABE$ and $\triangle CFB$,

$\angle A = \angle C$ (Opposite angles of a parallelogram are equal)

$\angle AEB = \angle CBF$ (Alternate interior angles as $AE \parallel BC$)

By AA similarity criterion, we have $\triangle ABE \sim \triangle CFB$.

26.

Marking Scheme



5 Min

- Write the equation of the line and substitute values to find the required point. ($\frac{1}{2}$ M)
- State that the given point divides the segment in a specific ratio. ($\frac{1}{2}$ M)
- Use the section formula for the x -coordinate and solve for x . (1 M)
- Use the section formula for the y -coordinate and solve for y . (1 M)

Tip: Midpoint = $\left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2} \right)$

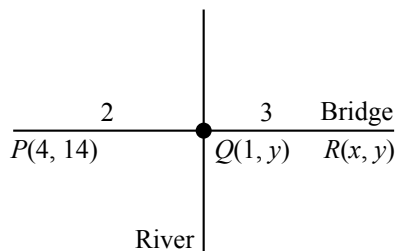
Given the river line equation: $y = 3x + 2$

Substituting $x = 1$ into the equation gives $y = 3(1) + 2 = 5$.

So, Q is at coordinates $(1, 5)$.

Given point P is $(4, 14)$.

$\therefore Q$ divides PR internally in the ratio $2 : 3$.



The coordinates of the point where the bridge ends, $R(x, y)$, can be found using the section formula:

$$\therefore 1 = \frac{2x + 12}{2 + 3} \Rightarrow 5 = 2x + 12 \Rightarrow x = -\frac{7}{2}$$

$$\text{and } 5 = \frac{2y + 42}{5} \Rightarrow 25 = 2y + 42 \Rightarrow y = \frac{-17}{2}$$

$$\text{Hence, } R(x, y) = \left(-\frac{7}{2}, -\frac{17}{2} \right)$$

27.

Marking Scheme



4 Min

- Assume a specific value is rational based on the given conditions. ($\frac{1}{2}$ M)
- Express the assumed rational number in terms of fractions or variables and rearrange the equation. ($\frac{1}{2}$ M)
- Solve the equation to isolate the irrational component. ($\frac{1}{2}$ M)
- Show a contradiction by proving that the irrational component should be rational, which contradicts the given condition. (1 M)
- Conclude that the original assumption is false and the expression is irrational. ($\frac{1}{2}$ M)

Given: $\sqrt{7}$ is irrational number

Assume $5 + 2\sqrt{7}$ is rational number then

$$5 + 2\sqrt{7} = \frac{a}{b}; b \neq 0$$

$$\Rightarrow 2\sqrt{7} = \frac{a}{b} - 5 = \frac{a - 5b}{b}$$

$$\Rightarrow \sqrt{7} = \frac{a - 5b}{2b}$$

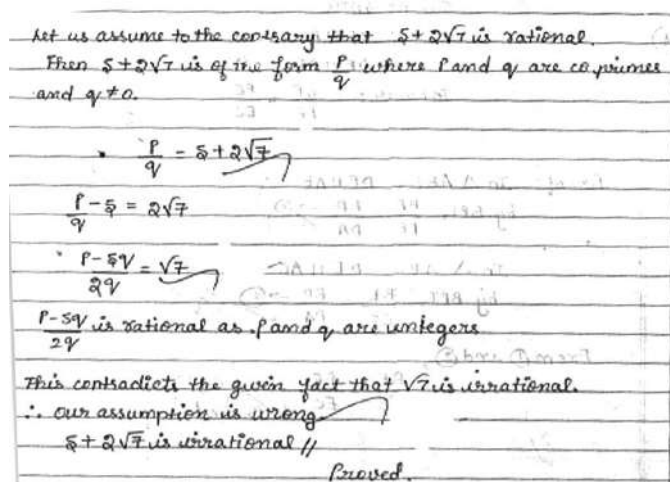
Since, a and b are integers, so $\frac{a - 5b}{2b}$ is rational number, but $\sqrt{7}$ is an irrational number. So equality can not exist.

Our assumption is not true.

Hence, $5 + 2\sqrt{7}$ is an irrational number

Topper's Explanation

(CBSE 2020)





Nailing the Right Answer

Students should correctly assume the contrary to apply proof by contradiction, handle algebraic manipulations carefully, and validate conclusions by maintaining the logic that irrational and rational numbers cannot produce rational sums.

28. (a)

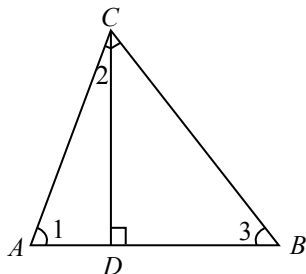
Marking Scheme



6 Min

- ☞ Use the angle sum property in the triangle to calculate the unknown angle and make a conclusion. (1 M)
- ☞ Apply the angle sum property again in another triangle to find another angle and conclude. (1 M)
- ☞ Prove that the angles are equal using similarity between triangles. (½ M)
- ☞ Prove similarity between the two triangles and use the similarity relation to establish the required result. (½ M)

Let $\angle A$, $\angle ACD$ and $\angle B$ is 1, 2 and 3 respectively.



In $\triangle ADC$,

$$\therefore \angle 1 + \angle 2 + \angle ADC = 180^\circ$$

$$\Rightarrow \angle 1 + \angle 2 = 90^\circ (\because \angle ADC = 90^\circ) \quad \dots(i)$$

In $\triangle ACB$

$$\therefore \angle 1 + \angle 3 + \angle ACB = 180^\circ$$

$$\Rightarrow \angle 1 + \angle 3 = 90^\circ (\because \angle ACB = 90^\circ) \quad \dots(ii)$$

From equation (i) and (ii) we get,

$$\angle 1 + \angle 3 = \angle 1 + \angle 2$$

$$\angle 3 = \angle 2.$$

In $\triangle ADC$ & $\triangle CDB$

$$\angle ADC = \angle BDC = 90^\circ$$

$$\therefore \triangle ADC \sim \triangle CDB$$

$$\frac{AD}{CD} = \frac{CD}{BD} \Rightarrow CD^2 = AD \times BD$$

Hence it is proved.

OR

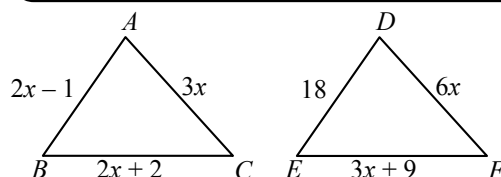
(b)

Marking Scheme



6 Min

- ☞ Use the similarity ratio between the triangles to set up an equation. (1 M)
- ☞ Solve the equation by rearranging the terms and finding the value of the variable. (1 M)
- ☞ Calculate the sides of the triangle based on the value of the variable. (½ M)
- ☞ Find the other side lengths using the similarity ratio and the known side lengths. (½ M)



Now, given $\triangle ABC \sim \triangle DEF$

$$\therefore \frac{AB}{DE} = \frac{AC}{DF} \Rightarrow \frac{2x-1}{18} = \frac{3x}{6x}$$

$$\Rightarrow \frac{2x-1}{18} = \frac{1}{2} \Rightarrow 2x-1 = \frac{18}{2}$$

$$\Rightarrow 2x-1 = 9 \Rightarrow 2x = 10 \Rightarrow x = 5$$

In $\triangle ABC$, $AB = 2x-1 = 2(5)-1 = 10-1 = 9 \text{ cm}$

$AC = 3x = 3(5) = 15 \text{ cm}$

$BC = 2x+2 = 2(5)+2 = 10+2 = 12 \text{ cm}$

Now, in $\triangle DEF$, $DE = 18 \text{ cm}$

$DF = 6x = 6(5) = 30 \text{ cm}$

$EF = 3x+9 = 3(5)+9 = 15+9 = 24 \text{ cm}$

29. (a)

Marking Scheme



4.5 Min

- ☞ Given polynomial: Set up the quadratic equation based on the problem. (1 M)
- ☞ Use the product of roots formula to form an equation and rearrange it. (1 M)
- ☞ Solve the quadratic equation to find the value of the variable. (1 M)

Tip: Product of roots = $\frac{c}{a}$

Given, $p(x) = (a^2 + 9)x^2 + 45x + 6a$.

Let the zeroes are α and $\frac{1}{\alpha}$

$$\therefore \text{Product of roots} = \frac{c}{a}$$

$$\Rightarrow \alpha \times \frac{1}{\alpha} = \frac{6a}{a^2 + 9} \Rightarrow 1 = \frac{6a}{a^2 + 9}$$

$$\Rightarrow a^2 - 6a + 9 = 0$$

$$\Rightarrow (a-3)^2 = 0 \Rightarrow a = 3, 3$$



OR

(b)

Marking Scheme

4.5 Min

☞ Set up the polynomial and the relationship between the roots based on the given conditions. (1 M)

☞ Use the sum of roots formula and rearrange to find the value of one variable. (1 M)

☞ Use the product of roots formula, substitute values, and solve for the unknown variable. (1 M)

Tip: Sum of roots formula: $\alpha + \beta = -\frac{b}{a}$ and

Product of roots formula: $\alpha\beta = \frac{c}{a}$

Let α and β are the zeroes of the polynomial

$$3x^2 - 8x + 2k + 1$$

then, $\alpha = 7\beta$ (Given)

$$\text{Sum of roots, } \alpha + \beta = -\frac{b}{a}$$

$$\Rightarrow 7\beta + \beta = \frac{-(-8)}{3} \Rightarrow 8\beta = \frac{8}{3} \Rightarrow \beta = \frac{1}{3} \text{ then } \alpha = \frac{7}{3}$$

$$\text{Now, product of roots, } \alpha\beta = \frac{c}{a}$$

$$\Rightarrow \frac{7}{3} \times \frac{1}{3} = \frac{2k+1}{3} \Rightarrow \frac{7}{3} = 2k+1 \Rightarrow k = \frac{2}{3}$$

30.

Marking Scheme

5.5 Min

☞ Set up the given trigonometric equations based on the provided conditions. (1 M)

☞ Derive an expression from the second equation and solve for the other variable. (1 M)

☞ Prove the final trigonometric identity using the derived expressions and conclude with the result. (1 M)

$$\text{Given, } \operatorname{cosec} \theta - \sin \theta = a^3 \quad \dots(i)$$

$$\sec \theta - \cos \theta = b^3 \quad \dots(ii)$$

$$\text{From Eqn (i), } \frac{1}{\sin \theta} - \sin \theta = a^3$$

$$\Rightarrow a^3 = \frac{1 - \sin^2 \theta}{\sin \theta} = \frac{\cos^2 \theta}{\sin \theta}$$

$$\Rightarrow a = \frac{\cos^{2/3} \theta}{\sin^{1/3} \theta} \Rightarrow a^2 = \frac{\cos^{4/3} \theta}{\sin^{2/3} \theta}$$

$$\text{From Eqn (ii), } \frac{1}{\cos \theta} - \cos \theta = b^3$$

$$\Rightarrow b^3 = \frac{1 - \cos^2 \theta}{\cos \theta} = \frac{\sin^2 \theta}{\cos \theta}$$

$$\Rightarrow b = \frac{\sin^{2/3} \theta}{\cos^{1/3} \theta} \Rightarrow b^2 = \frac{\sin^{4/3} \theta}{\cos^{2/3} \theta}$$

$$\text{Now, L.H.S} = a^2 b^2 (a^2 + b^2)$$

$$= \frac{\cos^{4/3} \theta}{\sin^{2/3} \theta} \times \frac{\sin^{4/3} \theta}{\cos^{2/3} \theta} \left(\frac{\cos^{4/3} \theta}{\sin^{2/3} \theta} + \frac{\sin^{4/3} \theta}{\cos^{2/3} \theta} \right)$$

$$= \cos^{2/3} \theta \cdot \sin^{2/3} \theta \left(\frac{\cos^2 \theta + \sin^2 \theta}{\sin^{2/3} \theta \cos^{2/3} \theta} \right)$$

$$= \sin^2 \theta + \cos^2 \theta = 1 = \text{R.H.S Hence proved.}$$

31.

Marking Scheme

5 Min

☞ Set up the problem using the dimensions of the regular size and family size portions. (½ M)

☞ Find the volume of one regular portion using the formula for the volume of a cone. (1 M)

☞ Find the total volume of 5 regular portions. (½ M)

☞ Find the volume of one family-size portion using the formula for the volume of a cylinder. (½ M)

☞ Compare the total volumes to conclude which option gives more volume. (½ M)

Tip: Volume of a cone: $V = \frac{1}{3} \pi r^2 h$, Volume of a cylinder: $V = \pi r^2 h$

Given, regular size (cone):

Diameter = 16 cm, so radius $r = 8$ cm

Height $h = 30$ cm

For family size (cylinder):

Diameter = 20 cm, so radius $r = 10$ cm

Height $h = 30$ cm

Volume of one regular portion (cone):

$$V_{\text{regular}} = \frac{1}{3} \pi r^2 h = \frac{1}{3} \times 3.14 \times 8^2 \times 30$$

$$= \frac{1}{3} \times 3.14 \times 64 \times 30 = 2009.6 \text{ cm}^3$$

∴ Volume of 5 regular portions:

$$V_{5 \text{ regular}} = 5 \times 2009.6 = 10048 \text{ cm}^3$$

Volume of one family size portion (cylinder):

$$V_{\text{family}} = \pi r^2 h = 3.14 \times 10^2 \times 30$$

$$= 3.14 \times 100 \times 30 = 9420 \text{ cm}^3$$

Yamir and his friends should choose the 5 regular portions to get the most popcorn, as $10048 \text{ cm}^3 > 9420 \text{ cm}^3$.

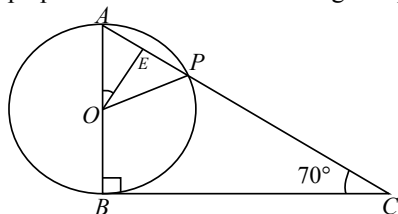
32. (a)

Marking Scheme

15 Min

- ☞ The tangent at any point to a circle is perpendicular to the radius through the point of contact. Use this property to find the angle. (1 M)
- ☞ Given the angle in the triangle, use the angle sum property to calculate the remaining angles. (1 M)
- ☞ Apply the result from the previous step to find the desired angle. (1 M)
- ☞ Use the property of the chord being bisected to find the right angle. (1 M)
- ☞ In the triangle, use the angle sum property again to calculate the required angle. (1 M)

We know that the tangent at any point to a circle is perpendicular to the radius through the point of contact.



$$OB \perp BC \Rightarrow \angle OBC = 90^\circ$$

$$\angle ACB = 70^\circ \text{ (Given).}$$

$$\text{In } \triangle ABC, \text{ we have } \angle BAC + \angle ABC + \angle ACB = 180^\circ$$

(Angle sum property).

$$\Rightarrow \angle BAC + 90^\circ + 70^\circ = 180^\circ \Rightarrow \angle BAC = 20^\circ$$

Since, OE bisects the chord AP

$$\therefore \angle OEA = 90^\circ$$

Now in $\triangle AOE$, we have.

$$\angle AOE + \angle OAE + \angle OEA = 180^\circ$$

$$[\because \angle BAC = \angle OAE = 20^\circ]$$

$$\Rightarrow \angle AOE + 20^\circ + 90^\circ = 180^\circ \Rightarrow \angle AOE = 70^\circ$$

OR

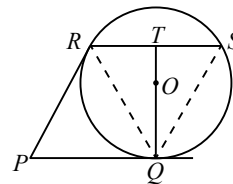
32. (b)

Marking Scheme

15 Min

- ☞ Use the property of tangents being equal from a common point to set up the given angle. (1 M)
- ☞ Apply the angle sum property in the triangle to calculate the required angle. (1 M)
- ☞ Use the perpendicular bisector property of the chord to establish that the chord is bisected. (1 M)
- ☞ Use the perpendicular bisector property to conclude the isosceles nature of the triangle. (1 M)
- ☞ Apply the angle sum property in the second triangle to find the required angle. (1 M)

Through Q , draw $QT \perp QP$. We have that the lengths of tangents drawn from an external point P to a circle are equal.



$$\therefore PQ = PR$$

In $\triangle PQR$, we have $PQ = PR$

$$\Rightarrow \angle PQR = \angle PRQ$$

$$\text{Also, } \angle PQR + \angle PRQ + \angle QPR = 180^\circ$$

(Angle sum property)

$$\angle PQR + \angle PRQ = 180^\circ - \angle QPR = 180^\circ - 30^\circ = 150^\circ$$

$$\Rightarrow \angle PQR + \angle PQR = 150^\circ \Rightarrow \angle PQR = 75^\circ$$

We know that, the perpendicular at the point of contact to the tangent to a circle passes through the centre.

$\therefore QT$ passes through the centre O of the circle.

We know that perpendicular from the centre of circle to a chord bisect the chord.

$\therefore QT$ is perpendicular bisector of RS .

$$QR = QS$$

$\Rightarrow \triangle QRS$ is an isosceles triangles.

$$\angle SRQ = \angle RSQ \Rightarrow \angle RSQ = 75^\circ$$

$$\text{In } \triangle QRS, \text{ we have } \angle SRQ + \angle RSQ + \angle RQS = 180^\circ$$

$$\Rightarrow \angle RQS = 180^\circ - 75^\circ - 75^\circ \Rightarrow \angle RQS = 30^\circ$$

33.

Marking Scheme

10 Min

- ☞ The side of the cubical container is given. Calculate the number of cans that fit along one dimension. (1 M)
- ☞ Calculate the total number of cans that can fit in the cubical container. (1 M)
- ☞ Use the volume formula for a cylinder to solve for the dimensions of the can. (1 M)
- ☞ Calculate the side length of the cube based on the value of p . (1 M)
- ☞ Find the internal volume of the cubical container based on its side length. (1 M)

Tip: Volume of a cylinder: $V = \pi r^2 h$, Volume of a cube: $V = s^3$

(i) The side of the cubical container as $2p$ from the figure.

$$\text{Here, } 2p \div \frac{p}{2} = 4 \text{ cans can be packed in each of}$$

the length's and the breadth's directions in the container.

$\therefore$ The total number of cans that can fit in the container as: $4 \times 4 \times 2 = 32$



- (ii) The formula for the volume of the can to find the value of p is: $\text{Volume} = \pi \times r^2 \times h$

$$\Rightarrow 539 = \frac{22}{7} \times \frac{p^2}{16} \times p$$

$$\Rightarrow p^3 = \frac{539 \times 7 \times 16}{22} \Rightarrow p^3 = 2744$$

$$\Rightarrow p = 14 \text{ cm}$$

$\therefore$ The side of the cube is $2 \times 14 = 28 \text{ cm}$.

The internal volume of the cubical container as $(28)^3 \text{ cm}^3$ or 21952 cm^3 .

34. (a)

Marking Scheme

12.5 Min

- | | |
|---|-------|
| Calculate the total distance covered by the thief. | (1 M) |
| The speed of the policeman forms an arithmetic progression (AP) with a constant increase. Calculate the total time taken by the policeman to catch the thief. | (1 M) |
| Calculate the total distance covered by the policeman as the sum of the first $(n-1)$ terms of the AP. | (1 M) |
| Simplify the equation to solve for n , the time taken by the policeman to catch the thief. | (1 M) |
| Solve for n , using the possible value, and calculate the final time for the policeman to catch the thief. | (1 M) |

Let the total time taken to catch the thief be ' n ' minutes.

$\therefore$ Speed of thief = 100 m/min. ,

$\therefore$ Total distance covered by the thief = $100n \text{ m}$

The speed of the policeman forms an AP with a constant increasing speed of 10 m/min.

Thus the series is $100, 110, 120, 130, \dots$

As the policeman starts after a minute, so time taken by the policeman to catch the thief is $(n-1)$ minutes.

$\therefore$ Total distance covered by the policeman

= $100 + 110 + 120 + \dots (n-1)$ terms

$$\therefore 100n = \frac{n-1}{2} [200 + (n-2) \times 10]$$

$$\left[\because S_n = \frac{n}{2} [2a + (n-1)d] \right]$$

$$\Rightarrow 200n = (n-1)(200 + 10n - 20)$$

$$\Rightarrow 200n = (n-1)(180 + 10n)$$

$$\Rightarrow 200n = 180n - 180 + 10n^2 - 10n$$

$$\Rightarrow 10n^2 - 30n - 180 = 0 \Rightarrow n^2 - 3n - 18 = 0$$

$$\Rightarrow (n-6)(n+3) = 0 \Rightarrow n = 6 \quad [\because n = -3, \text{ is not possible}]$$

Hence, the policeman takes 6 minutes to catch the thief.



Nailing the Right Answer

Students should recognize the sequence as an arithmetic progression (AP) and accurately apply the AP sum formula. Carefully track the speeds, distances, and time alignment to ensure precise calculations throughout.

OR

(b)

Marking Scheme

12.5 Min

- | | |
|---|-------|
| Let the first term and common difference of the first arithmetic progression (A.P.) be defined. | (½ M) |
| Let the first term and common difference of the second arithmetic progression (A.P.) be defined. | (½ M) |
| Use the given ratio of the sums of the two A.P.s and apply the sum of the A.P. formula to both sequences. | (1 M) |
| Simplify the resulting equation to express the ratio in a simpler form. | (1 M) |
| Substitute the appropriate value of n and further simplify the expression to find the ratio. | (1 M) |
| Conclude the required ratio in the final simplified form. | (1 M) |

Let A be the first term and D be the common difference of 1st A.P.

Let a be the first term and d be the common difference of 2nd A.P.

Now, According to question.

$$\frac{S_n \text{ of 1}^{\text{st}} \text{ A.P.}}{S_n \text{ of 2}^{\text{nd}} \text{ A.P.}} = \frac{7n+1}{4n+27}$$

$$\therefore \frac{\frac{n}{2}(2A + (n-1)D)}{\frac{n}{2}(2a + (n-1)d)} = \frac{7n+1}{4n+27}$$

$$\Rightarrow \frac{2A + (n-1)D}{2a + (n-1)d} = \frac{7n+1}{4n+27}$$

Put $n = 2m - 1$, we get

$$\frac{2A + (2m-1-1)D}{2a + (2m-1-1)d} = \frac{7(2m-1)+1}{4(2m-1)+27}$$

$$\Rightarrow \frac{2[A + (m-1)D]}{2[a + (m-1)d]} = \frac{14m-6}{8m+23} \Rightarrow \frac{A_m}{a_m} = \frac{14m-6}{8m+23}$$

Hence, the required ratio = $(14m-6):(8m+23)$

35.

Marking Scheme

12.5 Min

- ☞ Set up the cumulative frequency table: calculate the total number of observations and identify the median class. (2M)
- ☞ Calculate the median using the median class, cumulative frequency, and the median formula. (1 M)
- ☞ Calculate the mode using the modal class, frequencies of the preceding and succeeding classes, and the mode formula. (1 M)
- ☞ Use the relationship $\text{Mode} = 3 \times \text{Median} - 2 \times \text{Mean}$ to solve for the mean. (1 M)

Tip: Median formula: $\text{Median} = l + \left(\frac{\frac{N}{2} - c.f.}{f} \right) \times h$;

Mode formula: $\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$

Classes	Frequency (f_i)	Cumulative Frequency ($c.f$)
0-20	6	6
20-40	8	14
40-60	10	24
60-80	12	36
80-100	6	42
100-120	5	47
120-140	3	50

$$\therefore \text{Here, } \frac{N}{2} = \frac{50}{2} = 25$$

Thus, the median class is 60 – 80

$$\therefore l = 60, f = 12, c.f \text{ of preceding class} = 24 \text{ and } h = 20$$

$$\text{Median} = l + \left(\frac{\frac{N}{2} - c.f}{f} \right) \times h = 60 + \left(\frac{25 - 24}{12} \right) \times 20$$

$$= \frac{185}{3} = 61.67$$

Modal class = (60 – 80) as it has the maximum frequency is 12.

$$h = 20, l = 60, f_1 = 12, f_0 = 10, f_2 = 6$$

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$$

$$= 60 + \frac{12 - 10}{2 \times 12 - 10 - 6} \times 20 = 60 + 5 = 65$$

Now, $\text{Mode} = 3 \times \text{Median} - 2 \times \text{Mean}$

$$\therefore 65 = 3 \times 61.67 - 2 \times \text{Mean} \Rightarrow 2 \times \text{Mean} = 185 - 65$$

$$\Rightarrow \text{Mean} = 60$$

Hence, Mean = 60, Median = 61.67, Mode = 65

36.

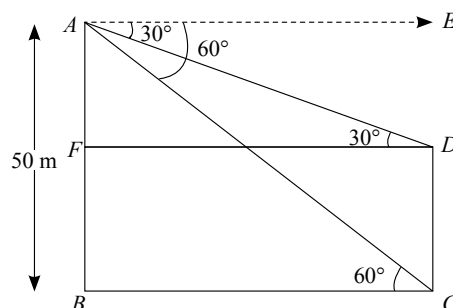
Marking Scheme

15 Min

- ☞ (i) Using alternate interior angles, relate the angles in the triangle due to parallel lines. (1 M)
- ☞ (ii) Apply the same property to establish another angle relationship based on parallelism. (1 M)
- ☞ (iii) Use trigonometric ratios to relate the angle to the sides of the triangle and calculate the required distance. (1 M)
- ☞ Find the width of the road using the trigonometric ratio to determine the horizontal distance. (1 M)

OR

- ☞ Use an alternate trigonometric method to relate the sides of the triangle to the angle and calculate the horizontal distance. (1 M)
- ☞ Solve for the remaining side using the trigonometric relationship. (1 M)



(i) Since, $AE \parallel FD$

$$\therefore \angle EAD = \angle ADF = 30^\circ \text{ [Alternate interior angles]}$$

(ii) Since, $AE \parallel BC$

$$\therefore \angle EAC = \angle ACB = 60^\circ \text{ [Alternate interior angles]}$$

(iii) In $\triangle ABC$,

$$\tan 60^\circ = \frac{AB}{BC} \Rightarrow \sqrt{3} = \frac{50}{BC}$$

$$\Rightarrow \text{Width of the road i.e., } BC = \frac{50}{\sqrt{3}} = 28.9 \text{ m}$$

OR

$$\text{In } \triangle ADF, \tan 30^\circ = \frac{AF}{FD}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{AB - BF}{FD}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{50 - CD}{\frac{50}{\sqrt{3}}} \left[\because FD = BC = \frac{50}{\sqrt{3}} \right]$$

$$\Rightarrow \frac{50}{3} = 50 - CD$$

$$\Rightarrow CD = 50 - \frac{50}{3} = \frac{100}{3} = 33.33 \text{ m}$$



37.

Marking Scheme**15 Min**

- ☞ (i) Identify the number of students who sleep after a certain time and exclude other students as needed. Calculate the probability. **(1 M)**
- ☞ (ii) Calculate the total number of students sleeping after a given time. Find the probability. **(1 M)**
- ☞ (iii) Identify the number of students whose favorite subject is a specific one and who sleep between certain hours. **(1 M)**
- ☞ Calculate the probability. **(1 M)**

OR

- ☞ Identify the number of students whose favorite subject is a specific one and who sleep between certain hours. **(1 M)**
- ☞ Calculate the probability. **(1 M)**

Tip: Probability = $\frac{\text{Number of favourable outcomes}}{\text{Number of total possible outcomes}}$

- (i) There are 33 students who sleep after 11 PM (7 English + 8 Mathematics + 10 Science + 8 Social Science). Excluding Social Science, there are 25 students (7 English + 8 Mathematics + 10 Science).

$$\text{Probability} = \frac{25}{150} = \frac{1}{6}$$

- (ii) The total number of students sleeping after 10 PM is 81 (33 from "After 11 PM" + 48 from "10 PM – 11 PM").

$$\text{Probability} = \frac{81}{150} = \frac{27}{50}$$

- (iii) The number of students whose favourite subject is Mathematics and sleep between 9 PM and 10 PM is 12.

$$\text{Probability} = \frac{12}{150} = \frac{2}{25}$$

OR

Students favoring Science or Social Science before 10 PM are:

Science (8 Before 9 PM + 9 PM – 10 PM) = 19;

Social Science (7 Before 9 PM + 9 PM – 10 PM) = 16

Total = 19 + 16 = 35

$$\text{Probability} = \frac{35}{150} = \frac{7}{30}$$

Nailing the Right Answer

Students should carefully analyze the data table, correctly identify relevant subsets for each probability calculation, and ensure all conditions are met. Pay attention to both numerical accuracy and total counts to avoid errors.

38.

Marking Scheme**15 Min**

- ☞ (i) Identify the equal angles and apply the AA similarity criterion. State the similarity between triangles. **(1 M)**
- ☞ (ii) Use the given total length and apply proportionality of sides. State the similarity ratio based on the given values. **(1 M)**
- ☞ (iii) Use proportionality of sides from similar triangles. State the ratio of corresponding sides. **(1 M)**

Use the ratio of sides to conclude that the ratio of perimeters is constant. **(1 M)**

OR

- ☞ Identify corresponding sides from the diagram and use similarity ratio. State angle equality. **(1 M)**
- Apply AA similarity rule to prove the triangles are similar. **(1 M)**

$$(i) \angle DPQ = \angle DEF$$

$$\angle PDQ = \angle EDF$$

Therefore $\triangle DPQ \sim \triangle DEF$

$$(ii) DE = 50 + 70 = 120 \text{ cm}$$

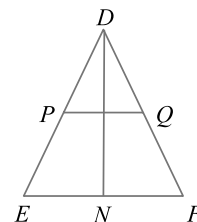
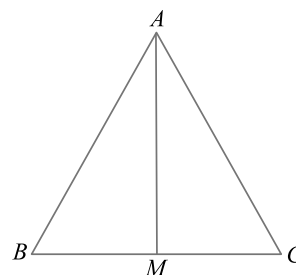
$$\frac{DP}{DE} = \frac{PQ}{EF}$$

$$\text{Therefore } \frac{PQ}{EF} = \frac{50}{120} \text{ or } \frac{5}{12}$$

$$(iii) \frac{AB}{DE} = \frac{5}{2} = \frac{BC}{EF} = \frac{AC}{DF}$$

$$\Rightarrow AB = \frac{5}{2} DE$$

$$\frac{\text{perimeter of } \triangle ABC}{\text{perimeter of } \triangle DEF} = \frac{\frac{5}{2}(DE + EF + FD)}{DE + EF + FD} = \frac{5}{2} (\text{Constant})$$

OR

$$\frac{AB}{DE} = \frac{BC}{EF} = \frac{BC/2}{EF/2} = \frac{BM}{EN}$$

Also $\angle B = \angle E$

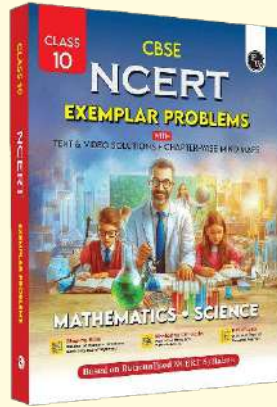
Therefore $\triangle ABM \sim \triangle DEN$.

The Must-Have Books for Conquering **Board Exams**



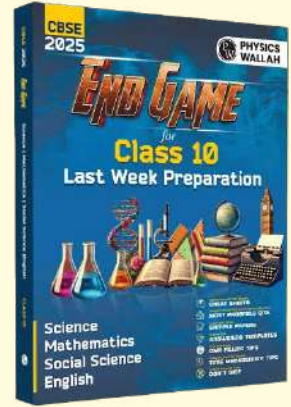
Amazon Link

PW Store Link



Amazon Link

PW Store Link



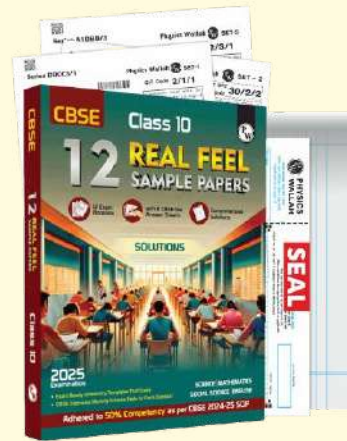
Amazon Link

PW Store Link



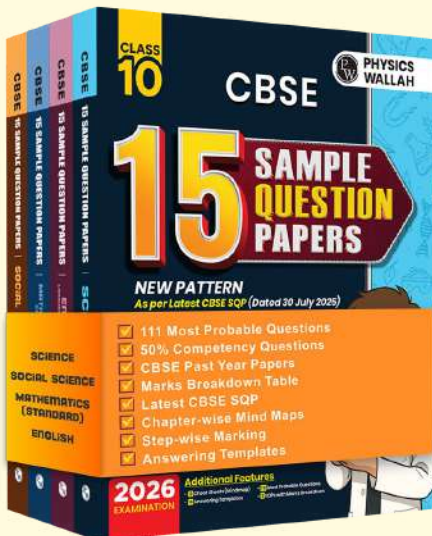
Amazon Link

PW Store Link



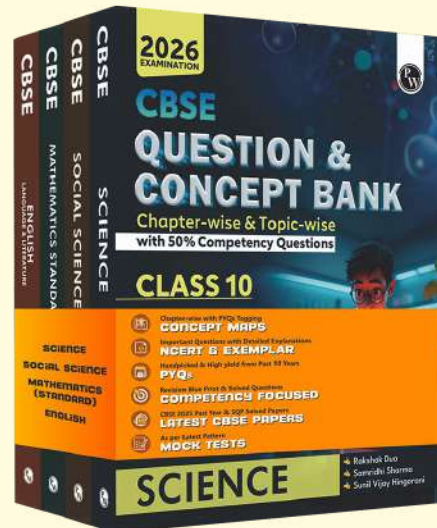
Amazon Link

PW Store Link



Amazon Link

PW Store Link



Amazon Link

PW Store Link

